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Engineering News-Record

August 21, 1930

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Riding the weights on the boom falls of a derrick erecting steel for the 85-story Empire State Building in New York

Steel Erection

85-Story Empire State Building in New York

◆

Drainage and Flood Control

Concrete Conduits in St. Louis

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Freyssinet Arch Construction

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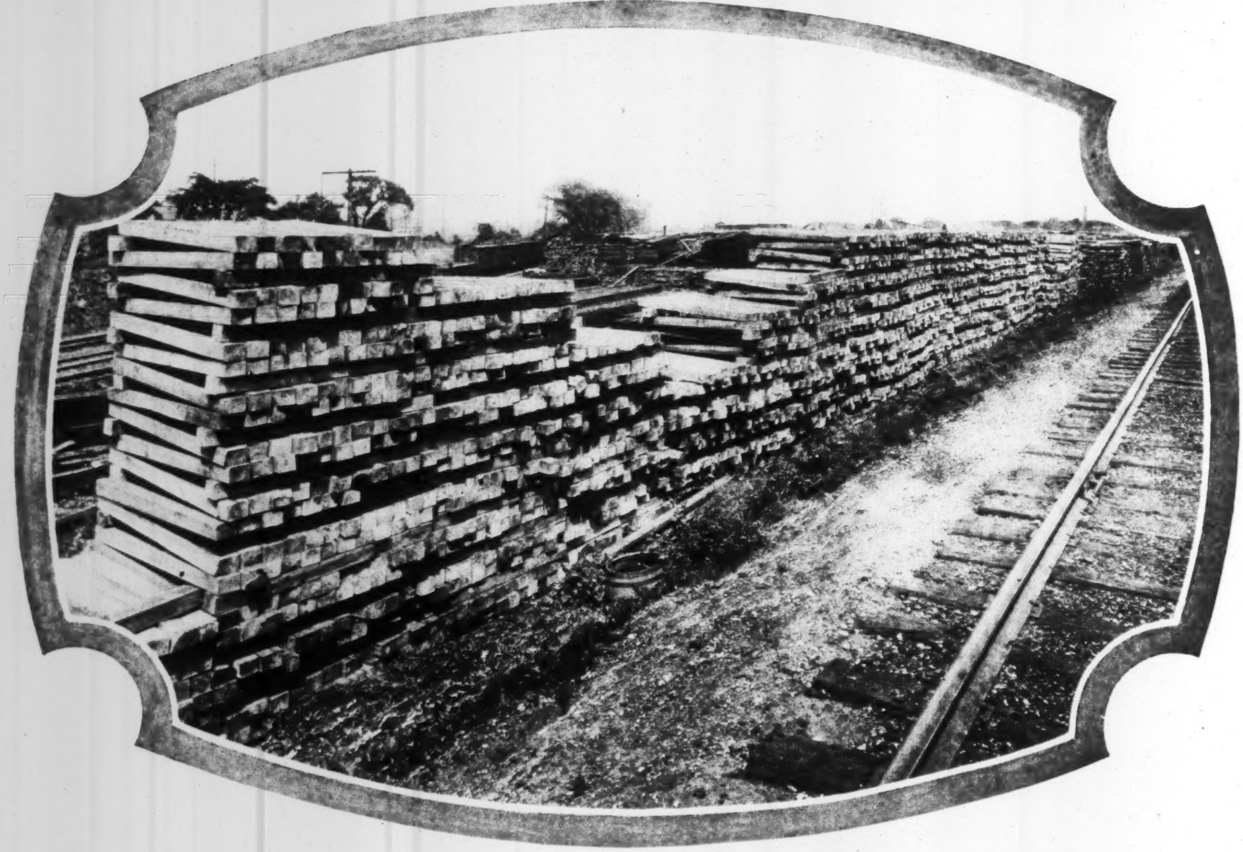

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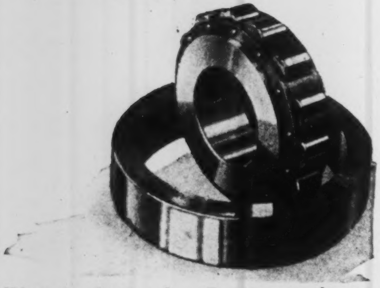

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

F. E. SCHMITT, *Editor*

Volume 105 NEW YORK, AUGUST 21, 1930 Number 8

Road Work as Relief

FOR THE first time in many decades, construction work is to be used as a means of relieving emergency distress. Drought relief plans of the federal government call for employing in highway construction the farmers who have lost their crops. Federal funds to the amount of $121,000,000 which would not have become available until 1931 are to be released by September. The plan is new, and involves serious difficulties, but it can be made to work. It will likely be slow in coming into action, for road contracts cannot be increased suddenly. Surveys and plans require time if anything useful is to be accomplished; special procedure of doing the engineering in the field may serve to save some of this time. Construction must be so arranged as to make it feasible to use farm labor effectively. Large responsibility rests on the state and local highway authorities in meeting these requirements, and equally on the Bureau of Public Roads. If the relief measures succeed, a doubly helpful effect will result, for not only will the drought-distressed farmer be aided but employment and business will be helped in many branches of industry which serve highways and farms.

Application to Local Roads

THERE are some opportunities for using untrained farm labor in paving main roads, but far better opportunities in improving local roads. Not only maintenance but also grading, widening and shaping of township and minor county roads have in many regions employed local farm labor for years. This is a serviceable, efficient field for application of the relief money; the money can easily be so applied as to produce permanent benefits. Federal-aid laws as they stand do not permit of using national funds on such minor roads, but since the paving of main roads cannot as readily serve the present purpose nor be accelerated quickly enough to meet the needs of emergency relief, it would be a wise step to modify practice for the moment to permit of local road work. It offers a promising way to accomplish real relief on other than a purely dole basis. And because the states must contribute equally with the federal government, the genuineness of their concern over drought relief will give assurance that the federal subsidy is not asked for in an idle way. Re-establishment of the existing federal-aid policy and restoration of the funds taken from the main highway system for drought relief can then be done by Congress at its next session.

Tasks of Growth

CENSUS figures of city and country population show that cities are keeping up their rate of growth without check. All present tendencies are for a continuance of this growth, and ten or twenty years from now we may be sure that small cities will be large, and large cities will be larger still. In this growth the problems of congestion and internal transportation which already beset all cities are certain to become ever greater. What headway is being made today is notoriously insufficient. We are not keeping abreast of the day's needs in this field, much less building for the greater needs of the future. But with the maintained growth of cities it is clear that in a very few years only strong and wise action can save the efficiency of city life and business. Engineering tasks of formidable size, growing up before us in proportion to the increase of city populations, still wait to be attacked with the vigor they require.

Professional Self-Respect

CONTRASTING with the events of the engineering competition which the city of Lima staged a few months ago comes the story of an attempt to conduct a similar competition at Phoenix. The city authorities invited the local engineers to bid on the engineering services for a sewer and sewage-disposal enterprise, but the engineers in this case took counsel with their self-respect and their professional ethics. The example of the Lima case having given a convincing picture of the immorality of such bidding, they declined to bid, but instead addressed the city council and set forth the unwisdom of attempting to engage engineering services by such a method. The representations bore fruit, we are glad to say, and the authorities selected engineers by direct choice. Evidently it is not impossible to lead city officials in the right direction if the proper methods are used and a firm attitude based on sound convictions is maintained by engineers. The Phoenix action will have emulation, as it deserves. In time, we may hope, the competitive-bidding evil may thus be eradicated.

Higher but Safer

THE MODERN skyscraper has ushered in many important changes in the field of building construction. Steel erection, for example, has had to be adjusted and regeared to many new requirements. Speed, because high cost of land makes early completion desirable, is one of the most important of these. Vehicular traffic constitutes a modern problem to be considered, since it affects steel delivery, which must be planned with increasing accuracy. And pedestrian traffic, which must be allowed to move along the sidewalks in safety, comes in for its share of attention. These are the fundamental requirements. The steel erector must meet others quite as pressing. The hazard of working 500 to 1,200 feet above the street is not to be passed over lightly; for one thing, high winds menace derrick guys and the handling of steel members. The problem of keeping ahead of the other building trades, and of protecting their workmen as well as the steel erectors themselves from dropped rivets, fitting-up pins and dolly bars, is a real one. Indeed, the dovetailing of speed and high-pressure work with safety measures has become the crux of the whole matter of erecting our tall buildings. Not many years ago the erection of large buildings cost many lives. What is the record of the modern steel erector? In New York the Chrysler Building cost one life, during the period of foundation construction; not a single fatality or serious injury marred the steel erection of the Manhattan Company Building; and to date, the epochal Empire State Building has not been charged with loss of life. The steel erectors may be proud of these records, for they have not just happened. They are the result of new safety features on tools and equipment, of education of workmen, and of carefully considered changes in method of erection. Buildings are being built higher, but they are being built more safely. The steel erectors are setting an example that deserves emulation in all branches of construction.

Perspectives and Bond Issues

IT IS a basic engineering principle that every project must be developed to its ultimate form on the drawing board, even though construction is to be undertaken in slow stages. But certain situations which periodically arise indicate that the use of the final plans, usually in the form of wash-drawing perspectives, in getting votes for bond issues on public works should be tempered with caution. It is good and perhaps necessary strategy for the politician to paint a rosy picture of what the taxpayers' dollars will build, but in numerous cases the practice has resulted unpleasantly when the taxpayer learns that his money will cover only drainage for the beautiful new park, grading for the splendid new boulevard, or the bare necessities, without a monumental building or sunken gardens, for the water-works. The situation with regard to municipal airports is a good example. Few airports are built complete, although very elaborate drawings, showing every building and runway that may be added in the next 25 years, are a part of the propaganda invariably fed to the voter. Unless it is made plain just how much construction the money asked for will provide, dissatisfaction is bound to arise. Pittsburgh seems to be the latest city to find this out. Nearly all of a two million dollar bond issue has been spent on grading, in accordance, as it happens, with the original plans, but the present well-graded field is a disappointing substitute for the busy and complete air terminal that many persons were evidently led to believe their money would build. As a result charges of misrepresentation, incompetency and dishonesty are flying about, quite unnecessarily and unjustly. St. Paul, whose airport also involved unusually expensive grading in the form of dredging and filling, was evidently somewhat more fortunate. Too much care cannot be exercised in describing bond issue projects to the voters. Their misunderstandings often prove to be a source of embarrassment for the engineers and political sponsors.

James H. Edwards

STRUCTURAL engineering has lost a man whom it can ill spare. For forty years James H. Edwards has been a leader in the development of steel structure; he played a large part in creating the steel mill building, and during the past decade he was the practical idealist who did more than any other man to bring fusion welding to recognition as a reality in building work. He labored quietly, unobtrusively, and in a kindly manner. His power to inspire and convince will be sorely missed by the just-developing welding art. Beyond the records of material achievement which he leaves, beyond the notable organizing work which he accomplished in the corporations which he served, is the monument he built for himself in the hearts of many, particularly young engineers, by his ready sympathy, his understanding counsel, and his tolerant appreciation of their views. At sixty-six most men have lost the pioneering spirit, but Edwards retained it to the last. Indeed, this faculty, the determined will to look forward, is what led him to accept welding as the equal of riveting, when his studies and tests had convinced him of its practicability. In large measure, the life of J. H. Edwards reached the ideal which is every engineer's goal.

A Drought Danger

CURRENT drought and post-drought menaces to the public health are being given attention by wideawake health and water-works officials, but there is danger that they will be overlooked by less alert officials and also by hundreds of thousands of countryside visitors now that the vacation season is at its height.

Public water supplies are liable to extra danger in times of drought through two main causes: shortage, causing temporary use of polluted sources; and low yields from existing supplies, affording inadequate dilution for pollution. After a drought there may be great menace to surface supplies from accumulated pollution being swept into the supply by heavy rains. Underground supplies present problems different from those of surface sources and may need special study by experts. Drought effects are slower to come and slower to be restored, the degree of variation depending largely upon the depth of the wells, and the distances from which they are fed.

Competent water and health officials will keep careful watch of public water supplies during both drought and post-drought periods, so as to avert threatened pollution as much as is reasonably possible and particularly so to cope with added pollution, when it occurs, by increased care in filtration and chlorination.

The gravest menace in times of water shortage attends the sudden adoption of an emergency water supply. Every community should make sure either that an emergency supply will not be needed under any foreseeable condition or else that plans for a quickly providable safe supply are ready for execution whenever needed. The chances are that special sanitary measures will be needed in case of an emergency supply, generally including chlorination. Temptation to make cross-connections with industrial water supplies not known to be safe should be resisted and if and where such cross-connections still remain they should be kept under close and competent control.

It is in the small villages and through the strictly rural areas that sanitary dangers from drought may be most serious. To the population primarily endangered, whether small or considerable, must be added, particularly at this season, tourists, campers and summer boarders innumerable, and also hosts of people left in the cities and dependent upon the country for their milk supply. Wells and springs get low or run dry, necessitating all sorts of water-supply shifts which may result in water unsafe for drinking and for dairy use. Here lie problems most difficult for state officials to deal with and for meeting which the local officials of villages and rural towns are generally not equipped. The growing use of pasteurization for city milk supplies has gone far toward protecting them from pollution, but the milk and the water consumed in the country, whether by local inhabitants or visitors, still has almost no public sanitary control.

Finally, two points may be given emphasis: *First*, "summer typhoid," whose peak time is now, is likely to be increased by drought conditions; and *second*, there are post-drought as well as drought menaces to water supplies, urban and rural. Every one even remotely subjected to drought conditions should heed these facts, but water and health officials above all.

Costly Passenger Terminals

COMPLETION of the new union station at Cleveland, built at a cost not far under a hundred million dollars, serves to call attention to the extent to which the railroads of the country are spending, or have spent in the last few years, vast sums upon urban passenger terminals. From Montreal and Philadelphia in the East to Los Angeles and Seattle in the West, there will be found new terminals in operation or under construction, the total cost of which runs into staggering figures. What lies back of these vast expenditures? Are they justified on economic grounds, or are they commitments which the railroads must make in the face of a declining passenger business, whether they will or no?

City passenger terminals, generally, are the most expensive part of any railroad system. They show little direct return upon the investment, and consequently railroad officials are unwilling to spend money upon them unnecessarily. But there are three factors always pressing for such expenditures, which must be recognized in all but the relatively new passenger terminals. They are obsolescence, competition of other railroads, and public pressure for modern facilities and conveniences. Obsolescence alone can be treated as an abstract mathematical problem. Theoretically, it should be the governing factor, but generally, as a practical matter, it is not. Too frequently new stations are built either to satisfy public clamor for something more pleasing to the eye and better adapted to modern conditions than the old and still serviceable terminal, or to put the railroad more nearly on a par with its competitors in the matter of outward appearances. Investments made to meet either of these demands cannot be justified purely as a matter of sound operating policy.

It is probable, however, that some of these station projects might have been deferred if the operating railroads had expended reasonable amounts for adequate maintenance or rehabilitation, instead of allowing the old stations to lapse into a condition of dirt, discomfort and dilapidation that warrants complaint from the community and the traveling public. A thorough overhauling may prove effective, if undertaken before public clamor develops, even though the train capacity remains limited, since the capacity is overtaxed only occasionally.

These considerations, however, bear less directly upon the subject of the enormous expenditures which characterize recent large city terminal developments than do several factors which enter after the decision to rebuild has been made. In them may be found an answer to the question of why such vast amounts are required.

Once the decision to reconstruct has been made, certain questions must be answered before work begins. Either the terminal should be rebuilt on its present site, generally in the heart of the city, or it should be built on a new site farther removed from the center of activities where real estate values are lower and proportionately larger benefits may be obtained from expenditures for real estate. In the large cities low land values in outlying districts must be matched against high land values of the central location where air-right development is a possibility.

Further, a new terminal invariably calls for the expansion of the numerous railroad facilities which, although reasonably adequate in the old terminal, could not be similarly limited in a new terminal, which must be laid out with an eye to the future.

Besides the purely railroad facilities, there are municipal considerations which add greatly to the cost. A station project becomes at once the center of a widening circle of demands for local improvements. Rebuilding a terminal, or building it on a new location, gives an opportunity for needed changes in street layout in congested city districts, or for trying out ideas as to adequate station approaches and parking facilities at new and less congested sites. Not infrequently changes in local city transit facilities are involved. In all of these municipal improvements the railroad must bear a part of the cost.

Grade separation is another important factor. No cities of any size will longer tolerate railroad tracks at street level, and vast sums may be involved in raising or depressing tracks approaching terminals.

Public objection to smoke also has to be taken into consideration. As a consequence electrification of the terminal lines must sometimes be included as one of the large items of cost. It brings, however, some compensation in operating economies not found in other expense items.

Because of these factors over which railroad companies have little control their planning, in some instances, has called for expenditures in addition to those required by the other commitments in the hope of securing revenue from part of the total cost through profitable leases of air rights and ground areas not actually needed. The sport arena of the North Station at Boston and the tower office building of the new Cleveland station are typical examples, but such developments are not practicable in all cases. Outside of these tangible sources of income and the intangible returns which the new terminal may bring in attracting new business there is nothing except operating economies to set over against the cost of the new terminal. Even operating economies are difficult to find in cases in which the old terminal has not outlived its service life.

In this piling up of largely uncontrollable expenditures, then, will be found the reason for the vast sums involved in modern city passenger terminal construction. Once the door is opened by the decision to rebuild a terminal the railroad company cannot close it against most of them. The public has been educated to expect and demand elaborate modern passenger stations.

These facts cannot be viewed with equanimity by railroad officials charged with the responsibility of balancing budgets. They should not be so viewed by municipal and civic bodies because ultimately the public pays for them in increased transportation costs. Also because recognition on the part of railroad officials of how uncontrolled expenditures pile up forces them to postpone the reconstruction of terminals which city officials believe to be a detriment to the community. The subject is one needing thoughtful study wherever new stations are contemplated. If, by some miracle of civic education, municipal authorities could be led to give due weight to the matter of cost in their planning, many needless expenditures might be avoided.

Planning and Control Permit Erection of 85 Stories of Steel in Six Months

Empire State Building in New York City Involving 57,000 Tons Goes Up in Record Time—Nine Derricks Starting Work on 425x198-Ft. Site Reduced to Five Above Twentieth Floor—Relay Platforms Necessary in Hoisting Steel—All Hoists Inside of Building

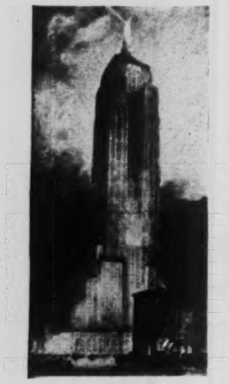


FIG. 1—EMPIRE STATE BUILDING, NEW YORK CITY

THE PLACING of more than 57,000 tons of structural steel in an 85-story building between the months of April and October is the task which has confronted the steel erector on the Empire State Building in New York City. Eighty per cent of this total tonnage was in place on Aug. 1, when the building had reached to about the 50th story. During July, 22 stories of steel were placed in 22 working days, involving regular hours and no night work. As progress has averaged about 10,000 tons of steel per month (working five days a week), it seems probable that the difficult schedule will be met.

This article is devoted to an account of the steel erector's methods and equipment which are of interest and value both because of the magnitude of the project and the careful planning and control which has been exercised. The steel tonnage in the Empire State Building exceeds by a large margin that used in any comparable structure. The Chrysler Building utilized 21,000 tons and the 70-story Manhattan Company Building, both in New York City, required 18,500 tons. The Merchandise Mart in Chicago, recently characterized as the world's largest building, required only 38,000 tons. The principal roof of the Empire State Building is 1,043 ft. above the curb, and latest plans contemplate the addition of a combination airship mooring mast and observation tower approximately 200 ft. tall above this point. The building's completed height will exceed that of the Chrysler Building, now the tallest structure, by something over 200 feet.

In preparing a plan of procedure for the steel erection, it was necessary to consider four major problems: (1) steel supply, which had to take into account the fabrication schedule and methods of delivery; (2) plant layout, including number, size and location of derricks and hoisting engines; (3) steel-handling methods at the job, which necessarily had to be considered as complementary to plant layout in the planning; and (4) actual erection procedure, including methods of setting, fitting up and riveting.

Steel Supply

The large tonnage in the building and the urgency for completion made it advisable to divide the fabricating contract between two firms, the American Bridge Co. and the McClintic-Marshall Co. Alternate sections from the basement to the roof, comprising from two to eight floors each, were assigned to each fabricator. All steel is shipped to a joint waterfront supply yard near Bayonne, N. J., and steel for erection is ordered from this supply yard one lift (two floors) at a time, as needed. Because of possible delays in loading and shipment it is necessary for the steel erector to order steel two days in advance of the time it is to be used. Since there is no storage space at the building site, it is absolutely necessary that everything be in readiness to erect the steel when it arrives.

Steel is delivered from the supply yard to docks on the East River waterfront by derrick-equipped lighters. Columns and heavy members are transferred to trucks at 23d St. while the smaller material comes ashore at 19th St. Since the Empire State Building is between 33d and 34th St. on Fifth Ave., the haul through city streets is not long. The largest shipping pieces were the two bottom column sections, the lower one 15 ft. 8 in. long, weighing 44 tons, and the upper one having about the same weight but being 33 ft. long. By using a two-wheel trailer, the trucks were able to handle these sections as easily as the smaller ones.

At the beginning of the job steel was delivered to the 33d St. side of the building; an unusually wide sidewalk on 34th St. made it impossible for the derricks standing in the excavation to reach trucks on this side. When erection had reached the second floor, however, the derricks could reach either street and steel was delivered on both the 33d and 34th St. sides until erection reached the 46th floor, when unloading on 34th St. was discontinued. All steel is now being received along 33d St. which, although narrow, is a westbound street permitting the trucks to reach the building from the East River waterfront in the most direct manner.

The erection plant is divided into two main parts—

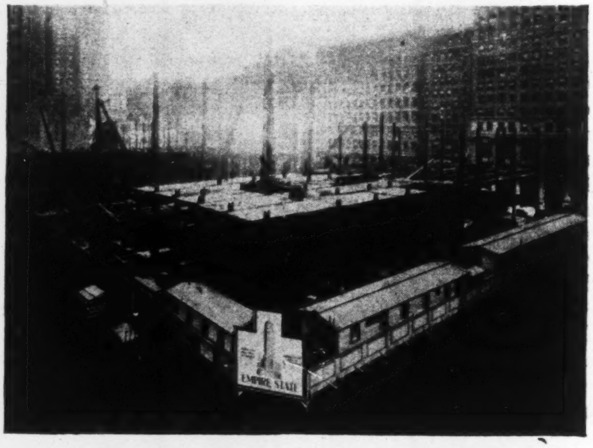


FIG. 2—EARLY ERECTION VIEW OF EMPIRE STATE BUILDING

At stage shown almost 8,000 tons of steel had been erected. Note extent of site which is 198x425 ft. General contractors' offices on bridge over 5th Ave. in foreground. Note complete planking of top floor forming a safe working platform for the steel erectors. Also at left, trucks unloading steel and materials along 33rd St. side.

erecting derricks and relay or transfer derricks, together with their respective hoisting engines. The relay derricks are placed on platforms rigged out from the face of the building to permit the derrick lines to reach the street over the setbacks. The erecting derricks are carried up with the steel. These various derricks and their respective positions are indicated in Fig. 3.

Erecting Derricks—The building site has a frontage of 198 ft. on Fifth Ave. and is 425 ft. deep along 33d and 34th Sts. Nine derricks were used to start the erection from the basement. These derricks had 75-ft. booms and 82-ft. masts. Four of them (on the corners) were rated at 20 tons while the other five, which had to erect the heavy column sections in the tower portion, were of 30-ton rated capacity, although capable of lifting 50 tons with safety. The initial location and the necessary shifts inward as erection progressed are indicated in the lower-story plan of Fig. 3. The initial outside locations of the nine derricks were maintained up to the sixth floor where the first and major setback occurs, extending completely around the building. Here, the four corner derricks moved inward. At the next setback, at the 22d floor, these four 20-ton corner derricks were dismantled and the tower steel carried up by the five 30-ton derricks which were also shifted inward one panel. At about the 50th floor, the 30-ton derricks were replaced by others of 20-ton capacity.

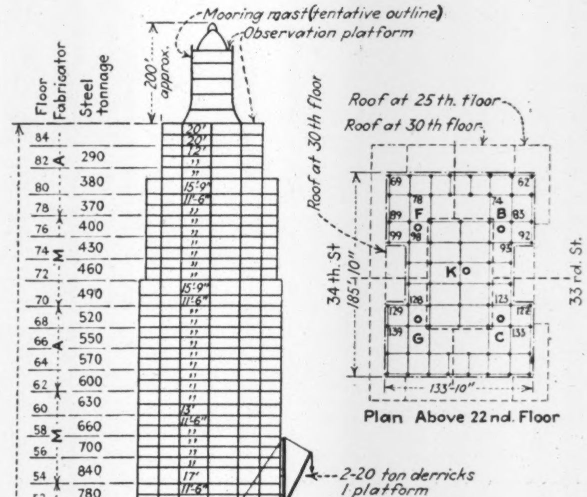

Mooring mast (tentative outline)
Observation platform
Floor
Fabricator
Steel tonnage
200' approx.
Roof at 25th. floor
Roof at 30th floor
Roof at 30th floor
34th. St.
185'-10"
133'-10"
33rd. St.
Plan Above 22nd. Floor
2-20 ton derricks 1 platform
1-15 ton derrick 1 platform
2-30 ton derricks 2 platforms
30 ton derrick on setback
1043'-7"
Fifth Avenue
34th. St.
424'-9½"
33rd. St.
197'-5"
Plan of Lower Stories
Curb, 33rd. St.
X-Original position of derricks
O-Final position of derricks
51,900 total tonnage
Story height
850T.

FIG. 3—ELEVATION AND PLAN DIAGRAMS OF EMPIRE STATE BUILDING SHOWING POSITIONS OF ERECTING DERRICKS AND RELAY PLATFORMS

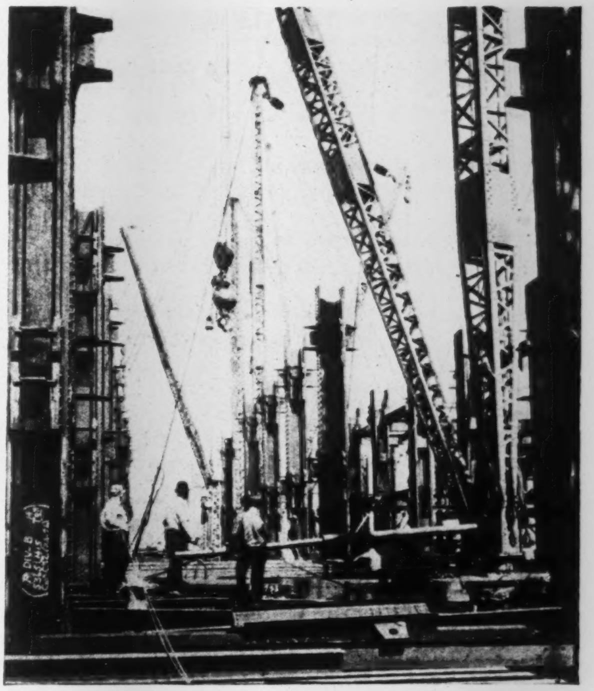


FIG. 4—READY TO ERECT FLOOR STEEL, EMPIRE STATE BUILDING

Columns set in two-story lengths. Hoisting engines for derricks inside of building below.

Electric hoisting engines are used. For the two 30-ton derricks, serving sections *B* and *C* (Fig. 3), these are of 100-hp. size since these derricks also hoisted steel from 33d St.; for the 20-ton derricks and the three remaining 30-ton derricks, the hoists are of 80-hp. size. All of the drums have a capacity of 3,500 ft. of ¾-in. wire rope. Special interest attaches to these hoists because they are of a new type, incorporating the most advanced safety features, designed by the hoist manufacturer to prevent recurrence of an accident which happened during the erection of the Chrysler Building when a hoist operator was rendered unconscious by a falling brick and dropped a load of steel that had just started up. As on older types of hoists, band service brakes controlled by foot levers are used to govern rope speed while lowering, or to hold the drums while the frictions are disengaged. In addition, however, emergency brakes, set by springs and released by hydraulic rams, are fitted to each drum over the frictions. These brakes act automatically in event of failure of power supply or the operator's failure to keep his feet on the service brake levers. The brakes are used in normal service also since the operation of the piston in the ram is gradual and thus tends toward smoother operation and prevention of cable breakage. The hoist is also provided with a so-called non-reversing brake which must be manually released by the operator when he desires to disengage the motor. The hoists will lift 9,000 lb. at 300 ft. per minute, and operate on three-phase 60-cycle alternating current at 220 volts.

The hoisting engines have been within the building site at all times, holes being left in the concrete floor-slabs for the hoist lines to pass through. At the start the hoists were in the basement close to the derricks which they served, and remained in that location until the sixth floor was erected. They were then jumped to the second floor where they remained until the 25th floor was reached when they were moved outside the building and lifted to the 25th floor by the 30-ton derricks on top, as shown in Fig. 5.

On the 25th floor the three hoists serving sections *B*, *C* and *K*, were grouped close together near the center of the building, one bay in from the 33d St. wall. The derricks serving sections *F* and *G* were in a similar location on the 34th St. side of the building.

When steel reached the 52d floor, the hoisting engines were again raised. More exactly, the three 80-hp. hoists on the 25th floor were raised while the two 100-hp. hoists were left on the 25th floor, to serve derricks placed on a relay platform at the 52d floor, the cables being led from these derricks through the roof at the 30th floor down to the 25th and into the hoisting engines. All erection-derrick hoists will remain on the 52d floor until the completion of the building, at least to the main roof level. It has not yet been decided what equipment will be used to erect the airship mooring mast although, assuming the necessary hoist will have to be placed at the 85th floor, the cost of carrying electric cables from their present terminus at the 52d floor will be so great as to suggest the use of a gasoline hoist for this topping-out work.

Relay Derricks—Until the sixth floor was erected steel was picked directly from the trucks by the erection derricks along either the 33d or 34th St. sides. After the setback at this floor was reached, however, the 75-ft. booms of the derricks could not reach the 34th St. curb and later as other setbacks occurred, the derricks along the 33d St. side became ineffective in the same manner. It was, therefore, necessary to resort to relay derricks on the setbacks or on plaforms built out from the edges of the building.

The first relay platform was on the sixth floor setback on the 34th St. side. Two 30-ton derricks were erected close to the back of the offset, and the sixth floor roof served as the transfer platform. One single-derrick platform was also placed on the 34th St. side in the center of the building at the 30th floor and was used until steel erection reached the 46th floor when it was discontinued.

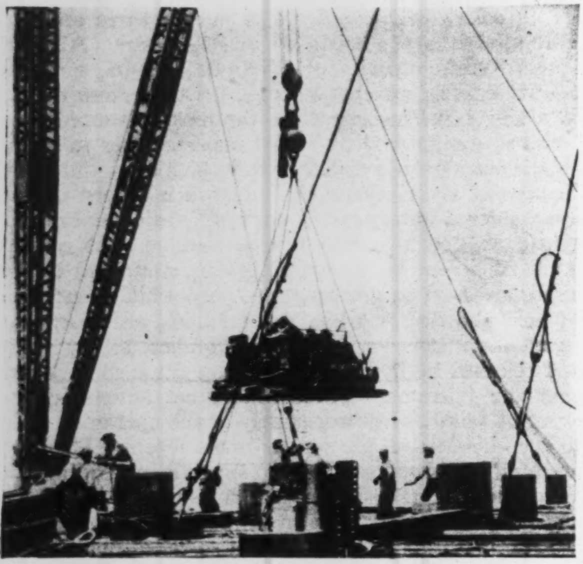


FIG. 5—DERRICK RAISING A HOISTING ENGINE TO A NEW WORKING LEVEL

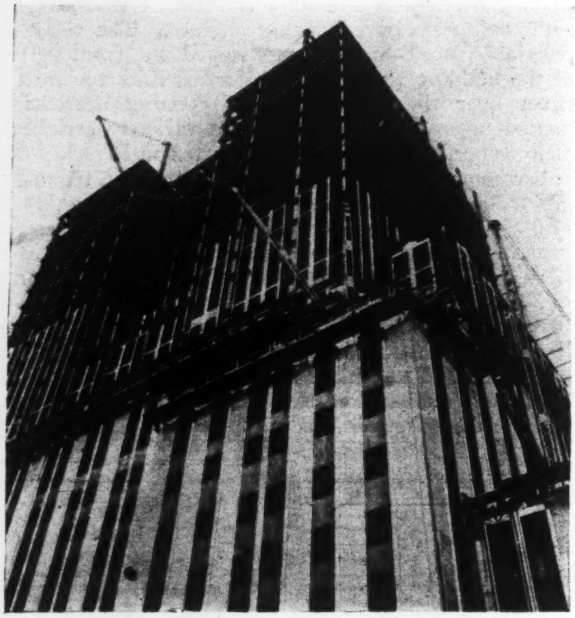


FIG. 6—EMPIRE STATE BUILDING WITH 42 STORIES OF STEEL IN PLACE

Second derrick from right is on 25th floor relay platform on 33d St. side. Derrick at right is for handling miscellaneous material. Note vertical strips of chrome-nickel steel and cast-aluminum sand-blasted spandrels.

On the 33d St. side, two relay platforms with one derrick each were constructed at the corners of the building at the 25th floor. When steel erection had reached the 56th floor, these platforms were supplemented by a two-derrick platform at the 52d floor. Thus all steel for the upper half of the building is being handled from 33d St. to the top of the building over two relay platforms. According to the contractors, it is not practicable to raise steel much more than 30 stories in one lift.

Details of the erection platforms are shown in Fig. 8, and their location is indicated in the elevation diagram of Fig. 3. It will be noted from Fig. 8 that the 52d floor platform is in the center of the building in a recess formed by a setback at the 30th floor, and that it is supported on a 36-in. rolled beam spanning 57 ft. between columns 92 and 122.

The derricks on these several relay platforms were of the following capacities: 6th floor (34th St.), 30 tons; 30th floor (34th St.), 15 tons; 25th floor (33d St.), 30 tons; and 52d floor (33d St.), 20 tons. All hoisting engines operating the relay derricks were located inside of the building. That for the 30th floor platform derrick was on the 25th floor and the two hoisting engines for the 25th floor platform derricks were on the second floor. The engines for the derricks on the 52d floor platform are on the 25th floor and had previously been used to operate the two erection derricks for sections *B* and *C*, as noted above. They are of 100-hp. size while the other relay derrick hoists are rated at 80 hp.

The masts of the 30-ton derricks on the 25th floor platforms were shortened to 60 ft. by removal of the center section, thus adding to their rigidity and increasing

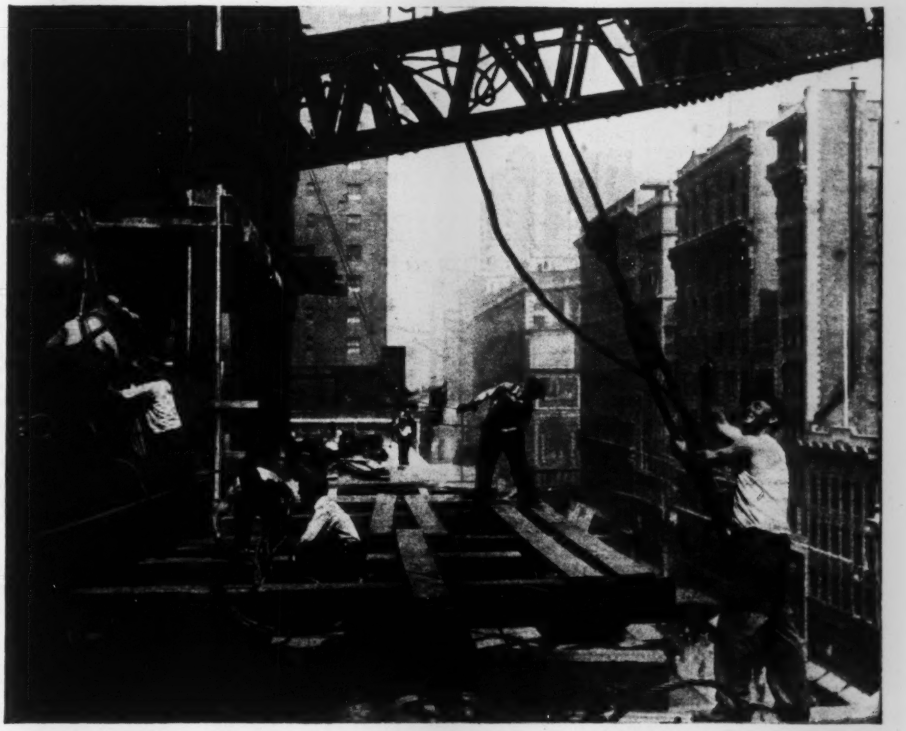


FIG. 7—STEEL RELAY PLATFORM AT 30TH FLOOR, EMPIRE STATE BUILDING
Men at left are attaching a load of floorbeams to falls of derrick on top. Man in center background is hoist signalman in charge of raising steel from 34th St. to the platform.

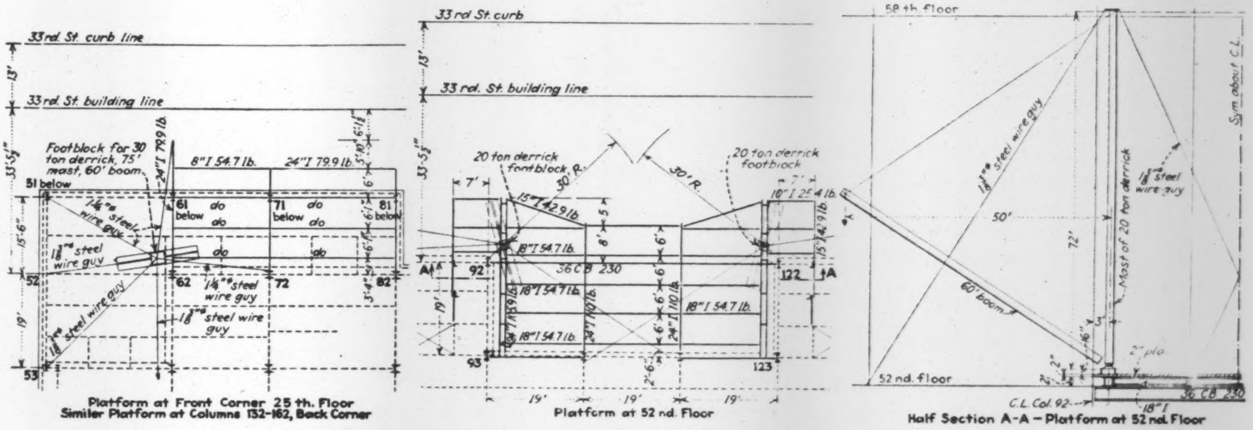
the safety factor on these derricks by almost 100 per cent. In addition to the usual guys, the masts were securely lashed to nearby building columns at several points throughout their height. The booms of these derricks were 60 ft. long. Similar rigging is used for the other relay derricks.

The methods of setting steel are not different from these used on buildings of much lesser heights. The column grillages in the basement were set in one piece. The heaviest, under column 105 was 15 ft. 8 in. by 9 ft. 3 in. in plan and was made up of thirteen 24-in. 120-lb. I-beams and a billet 54x6½x172 in. Other heavy pieces were the bottom columns which weighed 3 tons per foot, comprising in addition to the column section proper (a built-up member utilizing an H-section, two channels and cover plates) a pair of billet wing plates 13 ft. 8 in. wide by 8 ft. 5 in. high and 7 in. thick. The weights of the pieces to be handled decreased as erection progressed, the maximum being 30 tons at the 20th floor, 20 tons at the 30th floor, and 18 tons at the 40th floor, down to about 4 tons at the 85th floor.

The method of handling the steel from the street to the erection floor has been indicated above in the description of the erection and relay derricks. The erection derricks on top which lift the steel also distribute it to the other derricks and in addition erect the steel in their immediate vicinity . Erection is done from a completely planked floor. Tools cannot, therefore, be dropped on workmen below, and a fall from the topmost steel cannot be much over 25 ft. since the columns are set in two-story lengths. All columns are in place before the erection of floorbeams begins. A minimum of fitting-up bolts is used—two to each side of a column splice and one at top and bottom of a beam connection. This is possible since riveting of floorbeams follows only one floor behind steel erection. Column splices are riveted about four floors below the erection work. The view shown in Fig. 6 makes clear the rapidity with which all operations, including concrete-floor construction and frame inclosure, follow steel erection.

An average of four floors of steel has been erected per week since the beginning of the job. At the present time progress is at the rate of about a floor per day. At the beginning much time was consumed by shifting derricks, building relay platforms and the consequent re-reeving of hoist lines. Now that the last relay derrick has been erected at the 52d floor, these delays will be at a minimum, the only ones occurring when the erection derricks must be lifted upward. An average of about three hours is required to raise the five erection derricks two floors from one erection platform to the next.

The work described in this article has required 250


33rd. St. curb line
13'
33rd. St. building line
33'-5½"
Footblock for 30 ton derrick, 75' mast, 60' boom
24"I 79.9 lb.
8"I 54.7 lb.
24"I 79.9 lb.
5'-10"
6'-1½"
51 below
61 below
71 below
81 below
do
1¼"ø steel wire guy
1⅜"ø steel wire guy
15'-6"
6'
6'-1½"
6'-1½"
3'-4"
52
62
72
82
1¼"ø steel wire guy
1⅜"ø steel wire guy
19'
1⅜"ø steel wire guy
53
33 rd St. curb
33 rd. St. building line
20 ton derrick footblock
30' R.
30' R.
20 ton derrick footblock
7'
7'
15"I 42.9 lb.
10"I 25.4 lb.
15"I 42.9 lb.
5'
8'
6'
18"I 54.7 lb.
A
92
36 CB 230
122
A
18"I 54.7 lb.
24"I 110 lb.
24"I 110 lb.
24"I 159 lb.
18"I 54.7 lb.
18"I 54.7 lb.
19'
93
123
2'-6"
19'
19'
19'
58 th floor
1⅜"ø steel wire guy
1⅜"ø steel wire guy
Sym about C.L.
50'
72'
Mast of 20 ton derrick
60' boom
3'
6"
2" pla
2"
52 nd. floor
C.L. Col. 92
18"I
36 CB 230

Platform at Front Corner 25 th. Floor
Similer Platform at Columns 132-162, Back Corner

Platform at 52 nd. Floor

Half Section A-A – Platform at 52 nd. Floor

FIG. 8—DETAILS OF STEEL RELAY PLATFORMS, EMPIRE STATE BUILDING

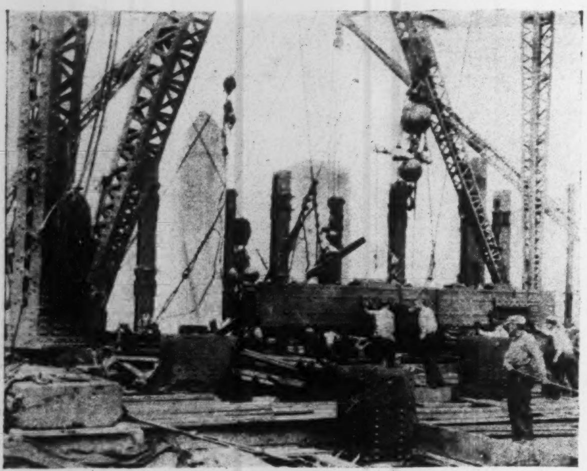


FIG. 9—MOVING A COLUMN SECTION INTO POSITION

Note burned holes in splice plates at top of column sections for derrick-falls attachment when up-ending the column into place. Ropes held by man in right foreground are attached to signal bells on hoisting engine located inside of building about 20 floors below. In background are Arnold Constable Building and Lincoln Building.

men since the time construction reached the twentieth floor. Previous to that the steel-erection force totaled about 300 men. The maximum number of riveting gangs used at any one time has been 38. At the present time sixteen riveting gangs are being employed. Each gang consists of two riveters, a heater, a bucker-up, and one or two helpers. Each of the erection derricks requires about nine men when steel is being set. Four or five men are required on the ground to make loads of steel fast to the derrick-boom falls, while the remainder of the force are on the relay platforms, or serve as signalmen, hoist operators and clerks.

The steel erection on the Empire State Building is being done by Post & McCord, New York City, of which Aubrey Weymouth is chief engineer and Andrew Morrison superintendent on the job. The steel work was designed by H. G. Balcom, consulting engineer, New York City. Starrett Bros. & Eken are the general contractors and Shreve, Lamb & Harmon the architects. Alfred E. Smith, former governor of the state of New York, is president of Empire State, Inc., the owner of the Empire State Building.

Los Angeles Harbor Levels Change

Comparative levels in the area surrounding Los Angeles harbor show that between 1919 and 1927 the outer part of the harbor rose by nearly 0.2 ft. as compared with the inner part, according to an article by G. F. Nicholson, harbor engineer of the city, in the *Bulletin of the Seismological Society of America* for December, 1929. The explanation offered is that a geological fault previously known to exist in the region just west of the harbor, and considered a dead fault, actually extends east across the harbor channel and is an active fault. Its direction is west-northwest to east-southeast. The comparative levels show a sharply marked difference of 0.07 ft. in the vicinity of this line, the region southwest of the line (outer part of the channel) having risen by the stated amount. However, an increasing rise is noted at greater distances from the line, so that near the mouth of the channel the total rise is 0.19 ft. from a point about 3 miles north.

Design of Combined Sewers Based on Runoff Conditions

Capacity Determined by Local Experience and Runoff Curves—Imperviousness of Area Drained by Sewer

IN STUDIES for the design of proposed relief sewers in the central section of Decatur, Ill., to supplement the present sewer system, information was secured showing the character of service rendered by existing combined sewers having minimum (or "bottleneck") and maximum capacities and under known conditions of imperviousness of the area served. This information, which is considered of general application in sewer design, was presented at the annual meeting of the Illinois Society of Engineers by W. D. P. Warren, consulting engineer, Decatur, Ill., in a paper which is abstrated below.

Both the existing and proposed sewers are on the combined plan and the original system has been in use for 40 to 45 years. During that time the city has grown from 15,000 to 60,000 population and its percentage of impervious area has increased greatly with the construction of buildings and street paving. As a result the sewers have reached a stage where frequent and serious flooding occurs. Furthermore, some of the extensions were not designed or built with as much care as were the original sewers, so that the capacity of the system as a whole is limited by numerous bottleneck conditions.

Studies of the situation indicate that in the formula $Q=CiA$, the expression Ci, or runoff in cubic feet per second per acre, bears a relation to the area of the existing system. In the formula, Q is total runoff in cubic feet per second; C is coefficient of runoff; i is intensity of rainfall in second-feet per acre, and A is the acreage of area served. From this condition the conclusion is drawn that emphasis may be placed on the value of the combined factors represented by the expression Ci, rather than on the separate and indeterminate values of C and i, especially where the character of service and the physical and economic conditions are established.

In Fig. 1, the curves A and B represent capacities of the existing sewers and establish clearly their limits as to capacity. These curves also indicate that there is a practicable method of determining the runoff per acre (Ci) without interpreting separate values for C and i, which are always more or less approximate. Curve A

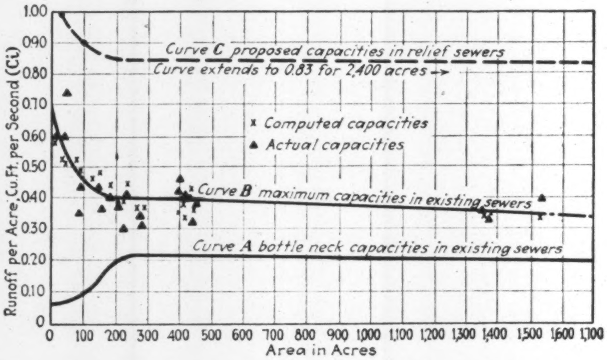


FIG. 1—CAPACITY OF PRESENT AND PROPOSED SEWERS, DECATUR, ILL.

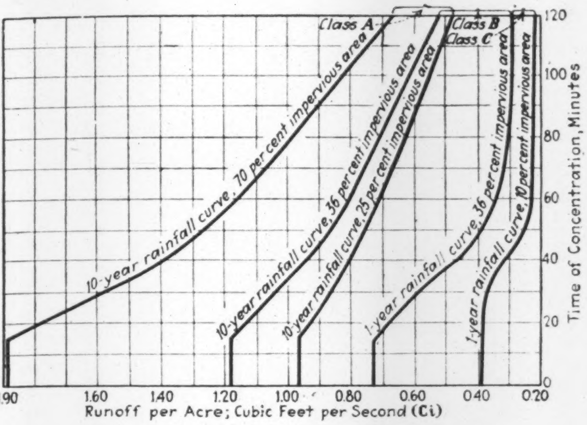


FIG. 2—RAINFALL AND RUNOFF CURVES

represents bottleneck capacities, where flooding is frequent and serious; it is to be noted that for areas of less than 200 acres there is a marked limit in capacity. Curve *B* represents maximum capacities, which are such as to provide satisfactory service with only occasion serious flooding. The data shown serve the valuable purpose of establishing rather definite limits in combined sewers—that is, actual capacities which have been determined to afford fairly satisfactory service under established conditions, and theoretical capacities which it may be desired to compute for other areas having different intensities of rainfall and different percentages of imperviousness.

Marks adjacent to curve *B*, Fig. 1, show a comparison of actual capacities determined by measurements and computed capacities based on theoretical curves for design of combined sewers. In this comparison the area drained, size of sewer, grade, time and coefficient of roughness were considered as identical. It was assumed that in each district 75 per cent of the area was residence property having a net imperviousness of 25 per cent, whereas the remainder was commercial property with an imperviousness of 70, giving a weighted average of 36 for the total area (see Table I). By trial it was established that a one-year rainfall curve for 36 per cent of impervious area would develop values of *Ci* almost identical with those obtained by direct measurements. It is interesting to note, therefore, the close relation of curve *B* to the actual and computed values of *Ci*. Typical capacities of the present and proposed sewers are shown in Table II.

In considering capacity, as determined by the methods above described and represented by the expression *Ci*, some of the unknown elements which affect the separate factors *C* and *i* include the following: volume of storage in sewers during time of rainfall and runoff; volume in inlet connections, house connections and miscellaneous underground drains, both old and new; volume of storage under pavements, driveways, walks, garages and outbuildings where the foundation or subsoil is ordinarily dry; and storage on the surface of pavements, gutters, walks, lawns, gardens and roofs. Another indefinite factor is the number and capacity of stormwater inlets. Other factors of equal or greater importance include the economic period of design, rainfall frequency to be provided for, property values and probably future percentage of imperviousness.

With these conditions in mind for Decatur, it was concluded that since curve *B* indicates that the maximum capacities in existing sewers will provide for rainfall runoffs likely to occur in periods of one to three years, it will be rational, in order to provide adequate capacity, to design the relief sewers for runoffs occurring once in about ten years. In the design of combined sewers at Decatur, considerable study has been given the matter of sewer limits, as suggested in an editorial in *Engineering News-Record* of Sept. 11, 1924, p. 409, entitled "Stormwater Sewer Limits." This editorial, reading in part as follows, suggests a line of investigation which would undoubtedly add much of value to this subject:

"It is an engineering truism that storm sewers large enough to carry the heaviest downpours would bankrupt a city. Accordingly a limit is set on the size of such sewers based on the known or assumed frequency of precipitation at a given rate and the resulting runoff to the sewers. The governing principle is that the damage caused by the excess rainfalls and runoffs at rare and uncertain intervals can better be met by property owners or the city as damages than to burden the city or the property owners in an assessment district with the huge capital charges that would be required to insure freedom from damage, if certitude were indeed possible. How many and what cities keep records that enable their engineers to establish a policy in this matter or, if one has been established, to check its soundness? And what is or should be the policy?"

Conclusion—While it is not possible to fix absolute sewer limits for a city of any particular population, nevertheless the adoption of some rational limits in sewer capacities, assuming somewhat typical conditions, will eliminate the occurrence of bottleneck conditions such as now seriously affect the existing sewers of Decatur. With this thought in mind, emphasis may be placed on the following features of design:

The design of combined sewers in cities of 100,000 population or over should be based primarily on local runoff experience—that is, on the character of service rendered by existing sewers of established capacity, with known conditions of imperviousness. For cities of 10,000 to 100,000 (Class A, Fig. 2), of 5,000 to 10,000 (Class B), and of 5,000 or less (Class C), the design should be based on runoff curves within the limits indicated in Fig. 2, assuming somewhat similar rainfall conditions. For combined sewers, 12 in. should be the minimum allowable diameter, and 2.5 or 3 ft. per second the minimum allowable velocity.

The limits here recommended should be used only as a general guide, since in many cases the limits for cities of one class will overlap those of other classes (Fig. *2*).

TABLE I—PERCENTAGE OF IMPERVIOUSNESS OF SEWER DISTRICTS AT DECATUR

		Roofs	Paving	Drives and Walks	Total
Residents:	Maximum	32	21	12	65
	Minimum	19	4	2	25
	Average	20	11	9	40
	Av. adopted	..	..	..	25
Business:	Maximum	61	39	..	100
	Minimum	42	31	..	73
	Average	47	38	..	85
	Av. adopted	..	..	..	70

Note: Corrections for average based on experience were made as follows: residence districts; roofs, 20 × 0.85 gives 17; paving, 11 × 0.7 gives 7.7; total 24.7; adopted, 25. Business districts; roofs, 47 × 0.9 gives 42; paving, 38 × 0.75 gives 28; total, 70.

TABLE II—SEWER CAPACITIES AT DECATUR

	Sec.-Ft.	Size of Sewer, In.	Acres Served
Bottleneck or low capacity, minimum	0.08	15	45
Bottleneck or low capacity, maximum	0.29	36x54	320
High capacity, minimum	0.30	48	226
High capacity, maximum	0.73	32x48	45
Proposed sewers, minimum	0.80	60 to 108	170 to 575
Proposed sewers, maximum	1.00	30	25

Design and Structure of Through Roads for Fast Traffic

Lessons From Westchester County Experience in Type, Location, Landscaping, Travel Speed, Crossing Eliminations, Curves, Grades, Pavement Widths, Curbs and Lighting

By L. G. Holleran
Deputy Chief Engineer, in Charge of Engineering and Construction, Westchester County Park Commission, Bronxville, N. Y.

HIGHWAY planning and design, as they have been developed in creating the Westchester County, N. Y., system of parkways, have determined a number of practices based on experience and reasoning, which have a lesson for similar undertakings in suburban road improvement. In general, the planning problem is that of separating through traffic from local traffic when both are dense, so as to minimize delays and confusion. Current practice offers three different methods of solving the problem: (1) widening the existing main thoroughfares; (2) bypassing the through traffic over existing roads at a distance from the main traveled routes; and (3) bypassing through traffic principally or entirely over new rights-of-way. It is the third procedure that has been followed in the system of roads being considered.

The fundamental planning involved laying out traffic routes through undeveloped territory, with rights-of-way of such widths that adequate marginal development in the way of grading and planting might be carried out. The requirements were highways designed for high-speed traffic, grade-crossing elimination except at insignificant intersecting roads, the installation of an adequate system of lighting and the enactment of zoning ordinances which provide that there may be only such development of adjacent territory as will bring about the increase in valuation which warrants the capital outlay for the improvement. Following these fundamentals, the practices worked out have been as follows:

Location and Landscaping

In locating the parkway roads the aim was to disturb the natural features of the landscape as little as possible. This objective was attained by widening and flattening the slopes of cuts and reducing fills by curvature. Borrow fill was usually necessary, but this was entirely economical, as large real estate development operations were in progress throughout the county and the contractors were sometimes even paid to take away material from rather large areas which required cutting down. In other instances they purchased such areas and sold the land at a profit after the grading operations were completed.

Topsoil over the whole area disturbed by the grading operations was stripped and piled until the grading was completed and was then respread on the raw slopes of the cuts and fills and seeded, or was planted with trees and shrubbery.

In the parkway areas the natural tree growth, rock outcrops, original stone walls and streambeds have all been retained and augmented by landscaping work. The aim has been to preserve or restore the natural original growth of trees and shrubbery. Swamps and marshy ground have been drained and converted to usefulness; streams cleared of debris, widened and deepened, and lakes and ponds created by low dams. Artificial waterfalls have been introduced by means of surplus boulders which it was necessary to dispose of in any case. Garbage dumps have been reclaimed (Figs. 2 and 3) and unsightly industrial works, coal pockets and railway embankments have been screen-planted with mature or quick-growing trees.

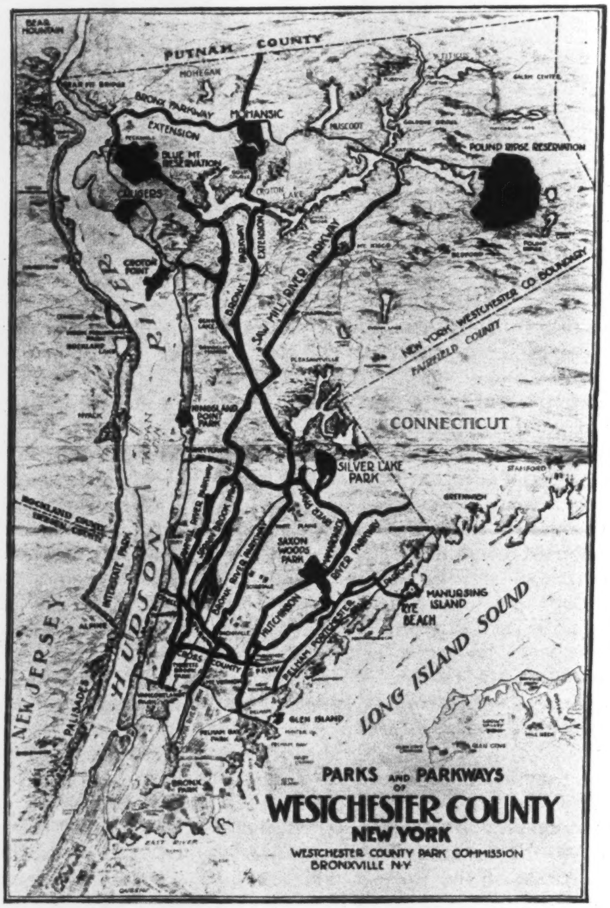

PUTNAM COUNTY
BRONX PARKWAY EXTENSION
MOHANSIC
MOHEGAN
MUSCOOT
POUND RIDGE RESERVATION
BLUE MT RESERVATION
CROTON POINT
CROTON LAKE
RIVER
SAW MILL RIVER PARKWAY
NEW YORK WESTCHESTER CO BOUNDARY
FAIRFIELD COUNTY
CONNECTICUT
KINGSLAND POINT PARK
SILVER LAKE PARK
SAXON WOODS PARK
HUTCHINSON RIVER PARKWAY
MANURSING ISLAND
RYE BEACH
LONG ISLAND SOUND
HUDSON
NEW JERSEY
GLEN ISLAND
PARKS AND PARKWAYS OF
WESTCHESTER COUNTY
NEW YORK
WESTCHESTER COUNTY PARK COMMISSION
BRONXVILLE N.Y.

FIG. 1—MAP OF WESTCHESTER COUNTY PARKWAY SYSTEM

Allowable Speed

A speed of 35 miles per hour is allowed and it is thought that with the exception of the Bronx River Parkway, where there are short-radius curves without superelevation, this could safely be raised to 40 miles per hour. However, with each rise in allowable speed, the maximum capacity of any drive or highway is lowered because of the greater space which must be maintained between any particular car and the one following. Traffic experts observed before the advent of four-wheel brakes that the maximum capacity of a roadway is reached at a speed of about 20 miles per hour. No observations have been made, to the writer's knowledge, on traffic made up of cars with four-wheel brakes, but it is reasonable to suppose that with such cars the maximum capacity of a drive is reached at a speed between 25 and 30 miles per hour.

That speeds up to 50 miles per hour will be permitted within the next few years on selected driveways designed for the purpose seems reasonably certain, but after several years' observation of comparatively high-speed traffic on the Westchester parkways it seems doubtful if there is any immediate prospect of higher permitted speeds for three principal reasons: (1) Only a very small percentage of the cars on the roads at the present time are in condition to travel at a sustained speed of more than 50 miles per hour. (2) A still smaller percentage of drivers are physically or temperamentally fit to drive a car at a higher speed than 50 miles per hour. (3) Unless radical mechanical changes are made in cars the capacity of a driveway built for sustained speeds of over 50 miles per hour would be so limited as to preclude, on economical grounds alone, the possibility of building it.

Grade Crossings and Access Drives

There is no impediment to traffic which so materially reduces the capacity of any route as crossings at grade or intersecting streets. It has, therefore, been the policy to separate the grades at all important crossings and to stagger the entrances and exits of unimportant crossings, or to employ the expedients described elsewhere to facilitate crossing of traffic.

In general, stone-faced reinforced rigid-frame structures (Fig. 4) have been used in the separation of grades. This type of structure was developed by Arthur G. Hayden, the commission's designing engineer, and was described by him in *Engineering News-Record*, April 29, 1926. This construction is materially less costly than the type of bridges in general use and is more readily adaptable to meritorious architectural treatment.

Roadway capacities are materially increased by grade-crossing eliminations, and there is also greater comfort in driving and fewer delays where no grade crossings exist. In all, 42 highway grade separations have been completed or are now under construction.

A detail requiring more careful consideration is the treatment at entrances and at access roads where grade-crossing elimination structures exist. Wherever possible the entrances and exits for such intersecting streets as are not eliminated should be staggered a sufficient distance to make it impossible for the driver crossing the parkway to dash into and across traffic. Where this is impossible, the pavement can be widened and safety islands introduced, as indicated in Fig. 5.

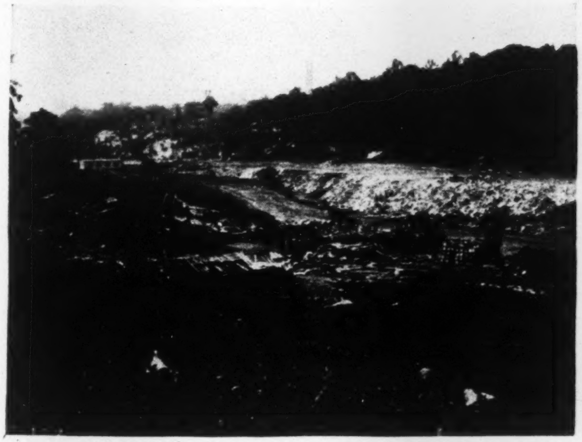


FIG. 2—BEFORE LANDSCAPING—A REFUSE DUMP

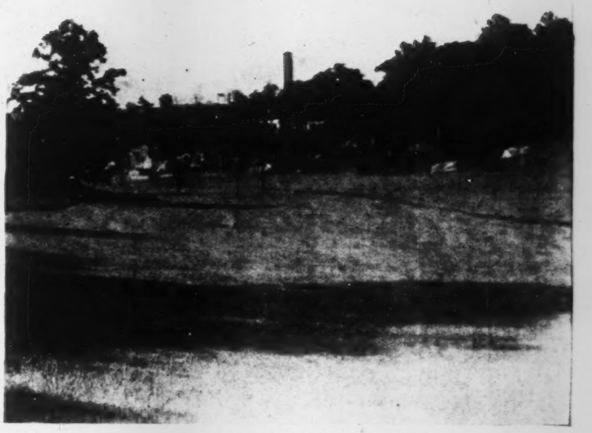


FIG. 3—AFTER LANDSCAPING— A GRASSY MEADOW

At grade-crossing eliminations four access roads between the parkway drive and the intersecting street should be provided, if that is practicable. This obviates the necessity for any crossing of traffic on either the parkway drive or the intersecting street. Unfortunately, the presence of costly buildings or other obstructions in one or more of the four quadrants often makes it impracticable to construct four access drives. In that event the direction signs, lights, etc., should be so arranged that there is no crossing of traffic on the parkway drive.

In only a few cases has it been possible to construct four access drives at the grade-crossing eliminations on the Westchester parkways. Two access drives have usually been constructed with reasonably good results, and in a few cases only one access was practicable. This is unsatisfactory and should be avoided, if possible.

Roadway Design

The parkway roads as now planned aggregate 160 miles, located as shown by Fig. 1. As these roads will carry exceptional volumes of traffic, roadway design has been studied closely and modified as experience has indicated that changes are desirable.

Curves and Grades—In the Bronx River Parkway, the first built, the curvature is sometimes as sharp as 180-ft. radius and many curves of less than 600-ft. radius occur. This parkway was designed in 1914, before the advent of high-speed cars in great numbers, but the sharp curvature was nevertheless a mistake which can and will be remedied when the driveway is repaved. In the design of the later parkways a minimum curvature of 750-ft. radius has ben followed. In vertical curves a minimum sight distance of 500 ft. has been generally followed and is thought to be satisfactory.

With the general use of high-speed cars, superelevation is necessary, though in some cases—especially on exterior curves around high ground—its introduction detracts from the landscape effects because the slope of the pavement is toward the natural slope of the ground rather than away from it, as would be more desirable.

Superelevations for the different degrees of curvature are computed for a speed of 30 miles per hour. However, as such a superelevation requires a difference in

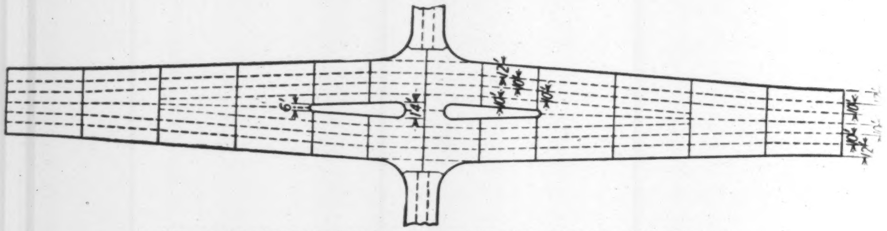


FIG. 5—TRAFFIC ARRANGEMENT AT GRADE CROSSING

elevation, between the sides of the pavement, of 4.9 ft. on a driveway 64 ft. wide at the minimum curvature of 750-ft. radius, and such a slope for the pavement was considered objectionable both from a landscape point of view and also from the point of view of slow-moving traffic, the superelevation actually used is about two-thirds that required by the computations.

For passenger traffic only, grades up to 8 per cent are permissible and have been used, though rarely. Where curbs are built, a minimum grade of 0.5 per cent has been fixed.

Widths of Pavement—On these high-speed through-traffic driveways the minimum width of pavement should be not less than 40 ft. To realize the full capacity of the driveway, the pavement should be definitely marked off into traffic lanes. The longitudinal construction joints which generally divide concrete pavements into 10-ft. lanes are not sufficient to keep traffic in the lanes. A sharper definition must be devised and traffic rules put in force which will keep traffic in definite lanes, except when passing. Such rules should include the provision that slow-moving traffic keep to the right.

As to the width of the traffic lanes, observation has shown that there is such a decided tendency for operators to avoid driving near the outer edges of the pavement, even where there is no guard rail or other apparent hazard, that it is evident that the outer lanes ought to be wider than the inner lanes. No lane ought to be less than 10 ft. in width.

Investigations conducted by the Bureau of Public Roads showed that drivers on state highways kept at an average more than 4 ft. from the edge of the pavement, and observation in the Westchester parkways indicates that only a small percentage of the drivers keep within an outer 10-ft. lane unless required to do so by density of traffic. The encroachment from one lane to another materially reduces the average speed and therefore the capacity of the driveway. The commission is, therefore, seriously considering the adoption of 12-ft. outer lanes and 10-ft. inner lanes in the design of future parkway drive pavement.

As to the total allowable widths of pavement in one driveway, the conclusion has been reached that a six-lane width constitutes the maximum which can be efficientl controlled. Where the volume of traffic requires greater width, either an entirely separate parkway shoul be laid out a reasonable distance from the first, or tw driveways constructed adjacent to each other.

Two One-Way or One Two-Way Roads—Observatio of traffic on the Westchester parkways during past year indicates that for the conditions to be met in the outskirt of any great metropolitan district it is considerably mor economical to provide a wide driveway (up to six lane of traffic) than it is to build two one-way drives. Th reason for this is that the driveways are necessarily designed for maximum traffic conditions, which usuall occur on Sundays and holidays when the residents of th cities drive out into the country on the most attractive and convenient traffic routes in the forenoon and retur again in the late afternoon or evening. This results i an intense wave of traffic in the late forenoon and earl afternoon in an outward direction and a corresponding wave in the opposite direction in the late afternoon and early evening. To provide for these waves on two one-way drives would require a 50 per cent increase in the total width of pavement, increased width of right-of-way, increase in the cost of grading, bridges, grade-crossing eliminations and lighting facilities, as well as the destruction of a far greater area of the original landscape features which so materially add to the attractiveness of these parkways.

The nature of this traffic wave is strikingly shown by the photograph reproduced as Fig. 6, which was taken on the Bronx River Parkway at Mount Vernon, N. Y., at about 11 a.m. on Sunday. The two solid lines of cars coming out from New York City are shown on the left and the sparse single line going toward the city is shown on the right. In the evening this condition is reversed.

Curbs—On the Bronx River Parkway no curbs were provided, but in the case of later parkways the design contemplates the use of curbs, although in general none

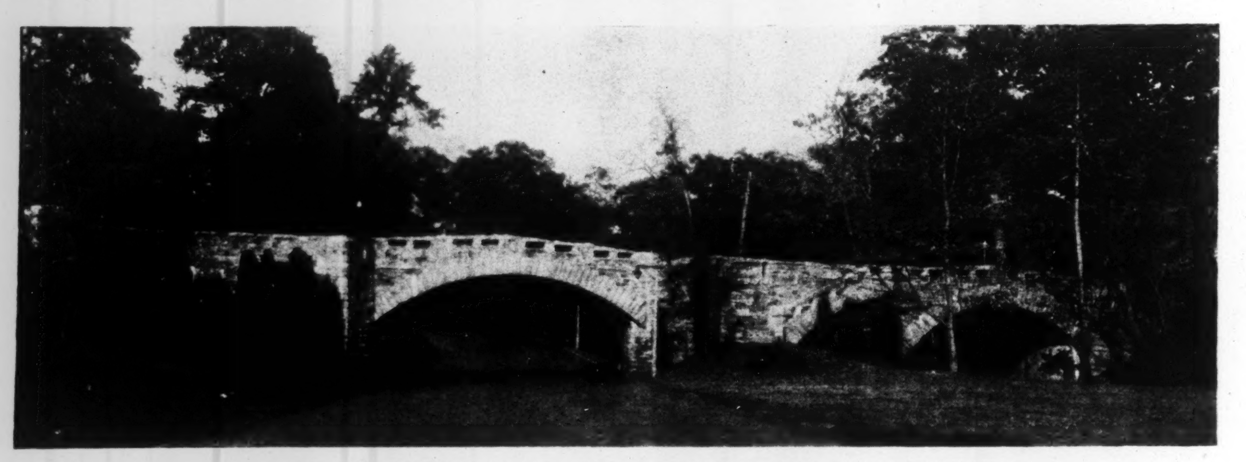


FIG. 4—GRADE SEPARATION AT ARDSLEY ROAD, BRONX RIVER PARKWAY

has been placed up to the present time, as the outer lanes of pavement on the later drives have not been constructed. The more recently constructed driveways (Hutchinson River Parkway and Saw Mill River Parkway) are designed for six lanes of traffic (64-ft. width of pavement) but only four lanes of pavement (40-ft.) have been constructed up to the present time. Original grading and width of bridge openings will accommodate the final width of pavement.

Curbs are necessary for two principal reasons: first, to bring the surface drainage to the inlets effectively, and second, to prevent motorists from driving and parking on the marginal lands or driving off the pavement entirely, which destroys shrubbery or natural growth and creates ruts in seeded areas. Curbs 3 in. high above the pavement are sufficient for both purposes and meet esthetic considerations better than 5- or 6-in. curbs.

Type of Pavement—On the Bronx River Parkway a plain concrete foundation 5 in. thick at the sides and 7 in. thick at the crown with 2-in. surface of various types of asphalt pavement was used. On the succeeding parkway drives a concrete pavement, reinforced top and bottom (100 lb. to 100 sq.ft.), 8 in. thick, with transverse joints 80 ft. apart, was used.

The very light color of new concrete pavement is objectionable both on account of the eyestrain from glare and on account of its lack of harmony with surrounding landscape features. The concrete has therefore been darkened by spraying a thin coating of asphaltic emulsion over the surface at a cost of about 4c. per square yard. The emulsion has a tendency to wear off after a time, but sufficient remains, together with the oil drippings from cars, to eliminate the objectionable color and glare.

Reinforced-concrete pavement has an advantage in cost in Westchester County of from 50c. to 60c. per square yard over an asphalt surfacing on a concrete base; it is much less likely to cause skidding in wet weather; it is easier to light at night and in the opinion of the writer it is the better type of pavement for high-speed, large-capacity through routes.

Lighting—Efficient lighting is necessary on these high-speed roads. On standard highway construction where long tangents occur and there is an absence of grade-crossing elimination structures, night driving even at relatively high speeds is reasonably safe without roadway lights. But the studied curvature throughout practically the entire length of the parkway, together with the occurrence of grade-crossing structures, trees near the edge of the pavement, and parapet walls of bridges adjacent to the pavement (there are no sidewalks on most such bridges), together with the absence of curbs during the initial period of operation, require lights to guide drivers and to show them the edge of the pavement.

As a guide to drivers on winding or curving roads, it is better to have the lights all on one side of the driveway, but effective lighting with standards all on one side cannot be accomplished efficiently for a greater width than four traffic lanes. For lights all on one side, the standards should be placed about 200 ft. apart, with lights 17 ft. above the pavement level. Modern refracting globes with 400-cp. lights should be used. For a width greater than four lanes the standards should be located on both sides of the driveway, 300 ft. apart on each side, and staggered so that the standards (taken as a whole) are 150 ft. apart. Special study should be given to the location of standards on curves, at entrance drives, in the vicinity of grade-crossing elimination structures and where other obstructions to the view occur.

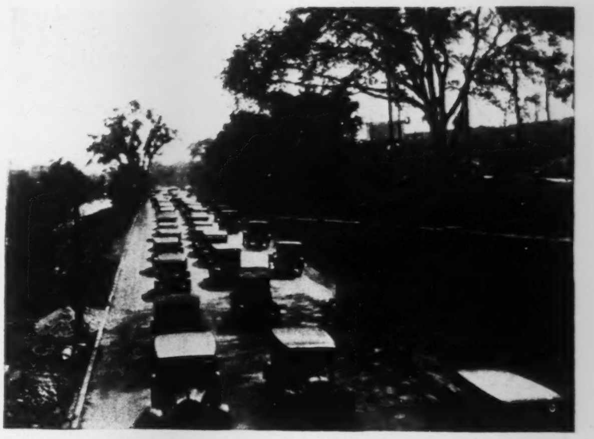


FIG. 6—UNBALANCED TRAFFIC ON BRONX RIVER PARKWAY

All work of the commission has been under the direction of its chief engineer, Jay Downer. In addition, the principal members of the staff are landscape architect, Gilmore D. Clarke; superintendent of maintenance and operation, Hermann W. Merkel; principal assistant engineer, Chester A. Garfield; division engineer, Edward Anderberg, in charge of field engineering work in the eastern division, and division engineer W. F. Welsch in the western division. L. R. Stuffler is superintendent of construction.

Rivets in Tension

Additional experimental data bearing on the subject of the tensile strength of rivets have been provided by a series of tests made at the engineering experiment station of the University of Illinois by Wilbur M. Wilson and William A. Oliver. This investigation is reported in the station's recent bulletin 210 from which the following is abstracted:

Strength of Rivets in Tension—(1) Hot-driven rivets having two button heads developed slightly greater tensile strength than that of the rod from which the rivets were made. (2) The only heads that failed were button heads flattened to $\frac{3}{8}$ in. and the heads of cold-driven rivets. The rivets having flattened heads developed 90 per cent of the strength of the rod, and the cold-driven rivets, even though they failed in the head, developed a strength considerably in excess of the strength of the rod. (3) The weakest rivet tested developed a unit stress of 58,160 lb. per square inch, based upon the nominal diameter of $\frac{3}{4}$ in. (4) The rivets having a long grip were not quite so strong as those having a short grip, probably because the long rivets did not fill the holes over their entire length. (5) The ability of a rivet to resist an external load that produces tension is not reduced by the initial tension in the rivet due to cooling.

Initial Tension in Rivets—(1) All hot-driven rivets having button heads had an initial tension equal to 70 per cent or more of the yield-point strength of the rod. (2) Cold-driven rivets had a low initial stress. (3) Rivets having a long grip had a somewhat greater initial stress than those having a short grip. Practically all rivets having two button heads and a grip of 3 in. or more had an initial stress equal to 90 per cent of the yield-point strength of the rod. (4) Rivets having a 2-in. grip had a slightly greater tension if driven with a press riveter than if driven with an air hammer.

Initial tension in the rivets was determined by two methods: first, by measuring the resilience of a rivet when the tension was released, and second, by determining the relation between the external load on a rivet and its elongation.

In general, the tests indicated that hot-driven rivets are subjected to a tensile stress nearly equal to the yield-point strength of the material. The tests did not show whether this tension affects the strength of the rivets in shear. The tests apparently justify the general use of rivets in tension if the shearing stress is not reversed.

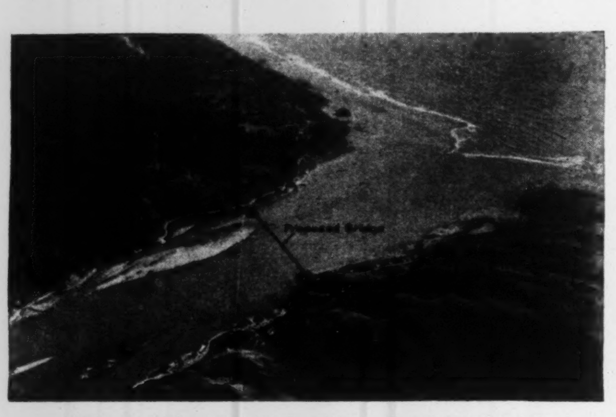
Oregon Highway Bridge to Be Built by Freyssinet Arch Method

Rogue River Span of Seven 230-Ft. Arches Will Replace Ferry on Pacific Highway

UTILIZATION of the Freyssinet system of concrete arch construction will be a feature of major interest in the building of the Rogue River highway bridge now under construction for the Oregon State Highway Commission. It is believed that this will be the first use of the method in this country. The bridge will span the river at a point about 45 miles north of the California line and within a few miles of the Pacific Ocean, on the Roosevelt highway. Upon completion it will eliminate a state owned and operated ferry at this same location which has become inadequate for the increasing volume of traffic.

The main portion of the structure is to consist of seven 230-ft. reinforced-concrete arches of the open spandrel type. At either end will be 144 ft. of concrete viaduct approach composed of 16-ft. arches, making a total length of 1,938 ft. for the entire bridge. The width will be 34 ft. to provide a 27-ft. highway and a 3½-ft. pedestrian way on either side. Abutments at the ends of the main arch system will rest on rock. The six intermediate piers, including two abutment piers, will be built on pile foundations, test borings showing that the riverbed material consists of sand and gravel for a depth of at least 70 ft. below streambed. Dividing the arches into three groups—a three-span group in the center flanked by two spans on either side—the abutment piers will rest on batter piles.

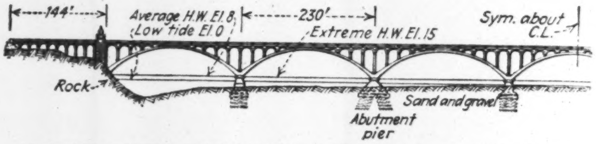
Lack of navigation restrictions permit low piers extending only to average high-tide elevation, or 8 ft. above low-tide level (El. 00). The piers will rest on a 7-ft. layer of seal concrete incasing the tops of the piles at about El. —25. At the top they divide to form the skewbacks for the two arches. Springing lines will be at El. 15, which is the extreme yearly flood line. The piers are designed as yielding or elastic, which is believed to be an innovation in the use of the Freyssinet method.



AERIAL VIEW OF ROGUE RIVER BRIDGE SITE
Roosevelt coast highway approaches from left foreground, and, on opposite side of river, continues south along shore.

Each of the seven pairs of arch ribs will have a 222-ft. span and a rise of 47 ft. They are designed as three centered arches with the exception of a short supplementary arc of long radius at the crown to provide a practically horizontal section for the jacks. Width of the ribs is 6 ft. and the thickness varies from 7 ft. 8 i at the springing line to 2 ft. 9½ in. at the crown. Th distance between the center line of the ribs is 22 ft. 6 i

The design of the arch ribs and the method of construction will follow in general what is usually referre to as the Freyssinet system. Descriptions of this metho of concrete arch construction have appeared from tim to time in technical literature. One of the early report was in *Engineering News-Record*, Sept. 18, 1924, p. 463 and a recent discussion appeared in *Public Roads*, Oct. 29 1929, p. 148. A structure of three 600-ft. arches now under construction by M. Freyssinet in Brest, France, was described in *Engineering News-Record*, Oct. 31, 1929, p. 691. The method permits reducing, to a large extent, such rib-shortening stresses as (1) contractions due to temperature, (2) contractions subsequent to the heating effect produced by setting, (3) elastic compression in the material, (4) shrinkage in the concrete, (5) plastic deformation and (6) minor movements in the piers.



ROGUE RIVER HIGHWAY BRIDGE BEING BUILT IN SOUTHWESTERN OREGON

The reduction in the deformation caused by these "parasitical" stresses is accomplished by leaving an opening at the crown of each rib in the concrete and inserting hydraulic jacks to allow for adjustments. These jacks permit the position of the arch to be maintained or corrected, following the construction period, until sufficient time has elapsed for the maximum rib-shortening to take place.

At this subsequent date the arch is set at exactly the correct position and the open section is concreted in. As a result of removing much of the uncertainty as to the distribution of stresses in the arch ring, it is possible to design more effectively; in the present case, it is stated, this has produced a saving of more than 10 per cent in the cost of concrete.

On the Rogue River bridge, when the superstructure is completed, the jacks will be inserted in keyways at the crown of each arch rib, and the adjustment will be made on the entire seven spans. Each group of ribs between abutment piers will be adjusted simultaneously to counteract and control stress transference through the elasticity of the intermediate piers. During progress of the work and the arch adjustment, an extensive telemeter installation will be made and rib stresses measured.

Because of the unusual design, the structure is to be a co-operative research project with the U. S. Bureau of Public Roads and the State of Oregon as participants. Stress control and experimentation will be under the direction of E. F. Kelley, chief of the bureau of tests and research of the Bureau of Public Roads. A. L. Gemeny will be in immediate charge of these experiments.

Plans were prepared in the office of C. B. McCullough, bridge engineer, Oregon State Highway Commission. Roy A. Klein is state highway engineer.

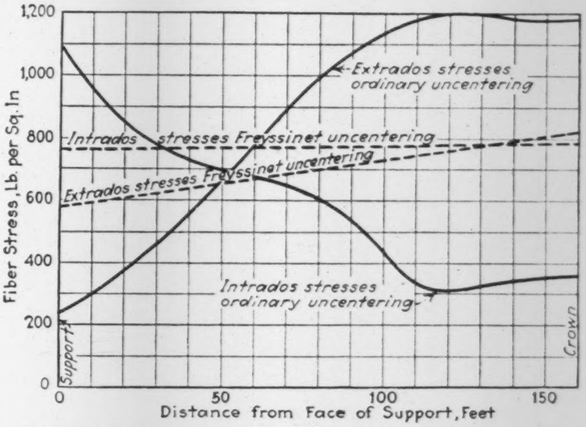
Contract for construction was let Jan. 16, 1930, to the Mercer-Fraser Co., of Eureka, Calif., for $568,181. The schedule calls for the completion of the piers in 1930 and for the placing of the arch ribs early in the following year.

Stresses Under the Freyssinet Method of Concrete-Arch Construction

BY J. T. THOMPSON

Associate Professor of Civil Engineering, The Johns Hopkins University, and Highway Research Specialist, U. S. Bureau of Public Roads

IN SUBMITTING the following article, which is presented as a supplement to the one on the preceding page, Professor Thompson writes: "Frankly, I am an advocate of the method and whereas I can assure you I have no axe to grind, I have made a careful study of the matter in the original literature and am convinced of its practicability, and have no doubt that unless some better method is meanwhile developed the arches which the Oregon state highway commission now has under construction will be merely forerunners of a great number." —EDITOR



COMPARISON OF STRESSES CAUSED BY TWO METHODS OF UNCENTERING A 322-FT. CONCRETE ARCH

THE PRINCIPAL economies and advantages which are claimed for the Freyssinet method of concrete-arch construction may be briefly summarized as follows:

(1) Elastic rib shortening and shrinkage stresses may be practically eliminated, with reductions in rib sections.

(2) By postponing the keying until the temperature of the air has reached a desirable mean value, temperature stresses may be considerably reduced.

(3) Secondary stresses due to lateral deflection of the abutments may be practically eliminated.

(4) Continuity may be developed at the ends of the centers in long spans, thus reducing deflections. [It should be noted that centers are struck by exerting jack pressures that widen the opening at the crown a sufficient amount to lift the rib clear of the centering.] Also, less rigid and hence cheaper centers may be used.

Since the method has been used most extensively in France, some data relative to stresses on typical Freyssinet concrete-arch bridges in that country may be of interest and value. The accompanying curves show a comparison between the uncorrected extrados and intrados stresses of the ordinary method of striking centers and the Freyssinet method on a 322-ft. arch at Villeneuve-sur-Lot. These stresses are the maximum ones occurring for dead and live loads, shrinkage, rib shortening and temperature variation. By manipulating the jacks so as to cause the proper opening at the crown, these curves may be corrected so as to produce the most favorable state of stress. The designer computes what stresses will be caused (1) by an opening of unity of a joint with parallel faces and (2) by a unit angular rotation of these faces about their centers of gravity. Any other openings or rotations will cause directly proportional stresses which may be added algebraically to the uncorrected stresses. The designer selects those values of opening and rotation which will bring about the desired corrected stress condition and then, when the air temperature has reached the desired value (usually a low one so that subsequent changes will cause a rise in the arch crown against the applied loads) and the shrinkage has practically all taken place, movement of the jacks provides the selected opening and rotation so that the arch can be permanently keyed.

The accompanying table shows the relative values of stresses from various causes in the case of three French arches and also indicates to what extent the stresses due to rib shortening, shrinkage and temperature changes may be corrected for. It will be noted that the highest stresses are reduced between 30 and 35 per cent.

The movements caused in the arch crown by the jacks may be exemplified by figures relative to the uncentering of the Villeneuve-sur-Lot bridge. On this structure the opening in the crown was of paper thickness, one half of the arch having been poured against the other, to which tallow had been applied to prevent bond. Four jacks were used, two just below the extrados and two just above the intrados. When the pressure was first applied, no appreciable lifting of the arch ribs occurred until the pressure had reached 260 tons per jack, at which pressure the joint was opened to $1\frac{1}{4}$ in. Thereafter, the raising of the arch was proportional to the jack movement and the pressure on the jacks increased very slowly. The thrust finally reached 270 tons per jack at which time the extrados and intrados openings were about 3 and $2\frac{3}{4}$ in., respectively, accompanied by a lift of the crown of $3\frac{1}{2}$ in., which was sufficient.

STRESSES AND POSSIBLE CORRECTIONS FOR THREE FRENCH ARCHES

	Villeneuve-sur-Lot, 322-Ft. Span				St. Pierre-du-Vauvray, 430-Ft. Span				Bernand, 558-Ft. Span			
	Crown		Support		Crown		Support		Crown		Support	
	Extrados	Intrados	Extrados	Intrados	Extrados	Intrados	Extrados	Intrados	Extrados	Intrados	Extrados	Intrados
Dead-load, direct	550	550	400	400	445	445	315	315	690	690	410	410
Dead-load, bending	—900	90	— 20	20	....	....	....	....	....	....	....	....
Live-load	190	80	160	190	200	200	200	215	230	110	255	220
Total	650	720	540	610	645	645	545	530	920	800	665	630
Rib shortening	85	— 95	— 80	75	60	— 75	— 75	60	85	—125	—130	130
Shrinkage	285	—320	—280	250	215	—255	—240	205	275	—420	—385	385
Temperature	170	65	55	150	95	50	50	120	165	85	75	230
Total	540	—350	—305	475	370	—280	—265	385	525	—460	—440	745
Correction for rib shortening	— 85	95	80	— 75	— 60	75	75	— 60	— 85	125	130	—130
for shrinkage	—227	256	220	—200	—170	205	195	—165	—220	335	305	—305
for temperature	— 58	64	55	— 50	— 45	50	50	— 40	— 55	85	75	— 75
Total	—370	415	355	—325	—275	330	320	—265	—360	545	510	—510
Total stress, ordinary uncentering	1,190	370	235	1,085	1,015	365	280	915	1,445	340	225	1,375
Freyssinet uncentering	820	785	590	760	740	695	600	650	1,085	885	735	865

St. Paul Builds an Airport One Mile From Post Office

Bottom Lands Filled, Leaving Bay for Hydroplanes—Triangular Layout for Runways—Paving and Lighting—Alidade for Cloud Heights—Hangars With Cantilever Roofs

By William N. Carey

Chief Engineer, Department of Public Works, St. Paul, Minn.

IN 1926 the city officials of St. Paul, Minn., chose a site for a municipal airport in low-lying river bottomland but only a mile from the main post office and within a five-minute drive from the center of the business district. Land 7 or 8 miles from the post office and requiring little grading was available, but the advantage of an unusually close site was deemed sufficient to justify the cost of filling to bring it above high-water level. The wisdom of the selection of this site has been demonstrated already.

About 300 acres are to be filled and improved, and 100 acres have been hydraulically filled so far, using approximately 2,000,000 cu.yd. and costing about $300,000 for filling and surfacing. Most of the land was purchased at $300 to $500 an acre. Adding the cost of fill and surfacing, this first part of the airport has cost approximately $3,500 per acre for land alone, a cost which compares favorably with the usual costs for terminal land near the downtown district of any large city. Expenditures have amounted to $800,000. A bond issue of $1,000,000 will be voted upon in a few months for more land, additional buildings and completion of the night-lighting installation.

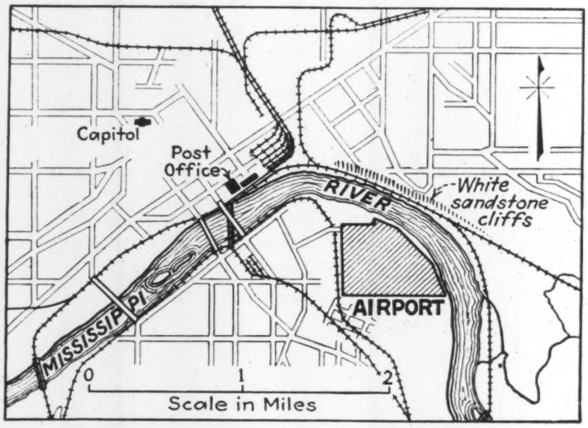

Capitol
Post Office
RIVER
White sandstone cliffs
MISSISSIPPI
AIRPORT
0
1
2
Scale in Miles

FIG. 1—ST. PAUL AIRPORT, CLOSE TO CITY

General Design—Numerous plans for the port were worked out in the office of the city engineer, most of them with several runways converging at a single point, but none of these wheel-type plans would fit the site and also meet the condition of progressive filling of the site. Thus the idea of building up the port in a series of triangles finally was forced upon the designers, and the plan shown in Fig. 2 was adopted late in 1928. After the first triangle has been filled and surfaced and has had the runways paved, the port will be in condition to receive from the U.S. Department of Commerce the desired "A-1-A" rating for airports. As air traffic develops, the airport can be extended without changes in the part already completed. Ample space is available north of the north hangar line for an automobile parking area, passenger terminal building, hotel, stores, park and other features. Arrangements for handling air-rail freight can be made readily, as a railway runs along the west side.

As the riverbed will not furnish sufficient fill for the ultimate development, it was decided that the borrowpit needed could be made into a hydroplane basin. The government dam downstream will hold the stage of the river fairly stable and keep the proposed basin full, while a small creek can be diverted into the basin so that it will not become stagnant.

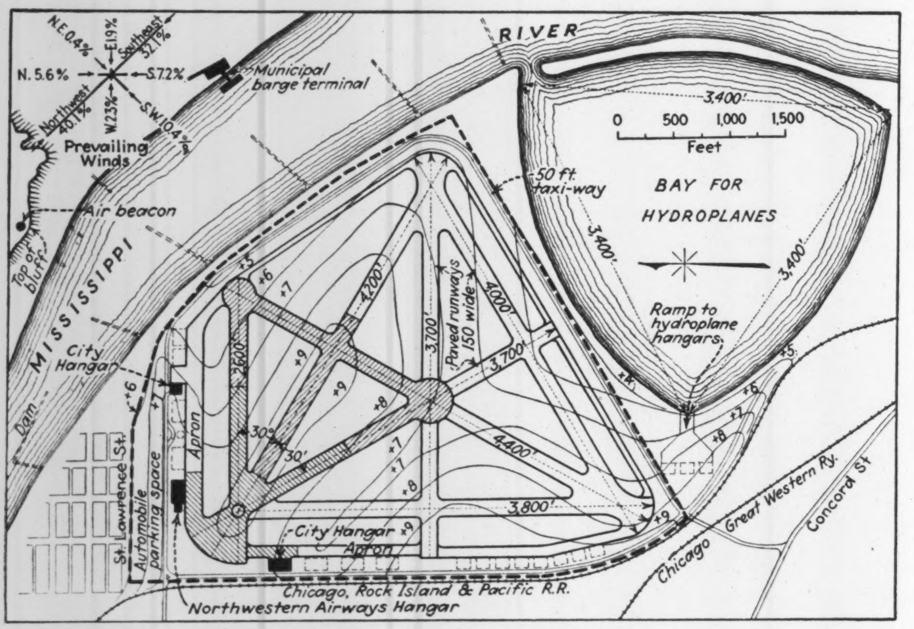

N.E. 0.4%
E. 1.9%
Southeast 32.1%
N. 5.6%
S. 7.2%
Northwest 40.1%
W. 2.3%
S.W. 10.4%
Prevailing Winds
Municipal barge terminal
RIVER
3,400'
0
500
1,000
1,500
Feet
50 ft. taxi-way
BAY FOR HYDROPLANES
3,400'
3,400'
Air beacon
Top of bluff
MISSISSIPPI
+5
+6
+7
4200'
3,700'
Paved runways 150 wide
4000'
3,700'
2600'
+9
+9
+8
Ramp to hydroplane hangars
City Hangar
Dam
+6
+7
Apron
30'
30'
+7
+7
+8
4400'
3,800'
+4
+5
+6
+7
+8
+9
St. Lawrence St.
Automobile parking space
City Hangar
Apron
+9
Chicago, Rock Island & Pacific R.R.
Northwestern Airways Hangar
Chicago Great Western Ry.
Concord St

FIG. 2—TRIANGULAR LAYOUT OF RUNWAYS

Drainage is a simple matter. Sanitary sewers discharging into the river are provided to serve both lines of hangars, while the surface has been shaped to drain without the aid of underdrains, the contour being planned with the floodlighting as well as the drainage in view. Since there will be 3 to 15 ft. of sand below the 9 in. of surface loam, it is not believed that bad soft spots will develop, but if they do, it will be easy to replace small areas of the surface loam with crushed stone to give excess water a quick passage into the underlying sand. It was feared that the thin layer of surface loam would be so drained that grass would die during the late summer season, but on 40 acres the new turf is growing remarkably well.

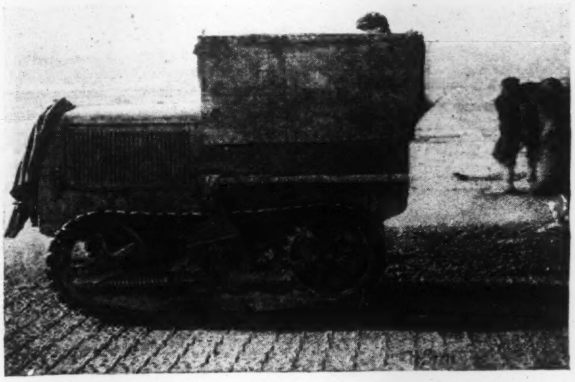


FIG. 3—TRACTOR USED AS PAVING ROLLER

A continuous wide paved apron in front of the lines of hangars and a taxi-way around the ends of the runways were provided in the plan. Two paved runways have been constructed for a part of their lengths, in the northwest portion. The pavement now in place and the limit of the fill at the end of the 1929 season are shown in Fig. 2.

Paving of Runways—The runway pavement in place consists of two convergent strips each 150 ft. wide and with 1,600 ft. of its ultimate length paved. This amounts to 76,500 sq.yd. of pavement, which cost $134,100, an average of $1.75 per square yard. Both runways have a 2-in. surface of hot-mix asphaltic concrete. The base of the first runway was made with 6 in. of crushed limestone rolled into the sand, while that of the second is a 3-in. hot-mix asphaltic concrete. Much of the hydraulic fill rests upon swampy ground, and while some subsidence has taken place, it was believed that additional subsidence would occur as the vegetable matter rotted and was compressed. For this reason, principally, a nonrigid type of pavement was selected and has proved satisfactory so far.

Mixed-in-place asphaltic types also were considered, but it was estimated that for sufficient thickness the cost would be more than $1 per square yard, due to coarseness of the sand fill. However, experiments will be made in 1930 to determine whether a satisfactory mixed-in-place runway pavement can be constructed at a sufficiently lower cost to warrant its adoption.

The pavement with rolled stone base is not as free from slight surface undulations as the one with asphaltic black base, though both are far more regular than the average runway surface. The crushed stone, with maximum 3-in. size, was spread over the sand about 6 in. deep and rolled with a 10-ton tandem roller, additional stone being added to low areas and again rolled. On this base, asphaltic cement was poured from spreader trucks at about 1 gal. per square yard, this being sprinkled with sand and again rolled. After the 2-in. asphaltic concrete had been laid, asphaltic cement at about 0.66 gal. per square yard was poured from spreader trucks. This asphaltic cement contained a large percentage of a volatile solvent, which after evaporation leaves the cement in a set condition.

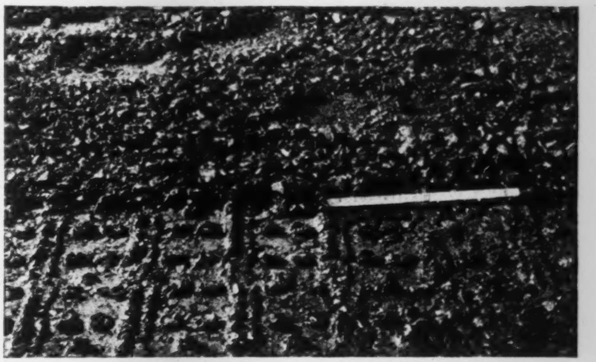


FIG. 4—ASPHALTIC BASE AFTER ROLLING

Trap-rock chips spread over the surface immediately were broomed and dragged to even distribution and then rolled, giving a sharply granular surface. Light airships with steel tail skids can land upon or take off from this type of surface with safety. An excessive amount of crushed stone was required, as it was forced into the sand fill by the roller and it was difficult to shape the surface to a plane. After the rock base was sprayed with asphalt and given its final rolling it presented more stability than was expected. Trucks loaded with 8,000 to 10,000 lb. of surface mix could be run directly upon the base without apparent injury to it.

Rolling With Tractor—The prospect of considerable loss of the more expensive blackbase due to compression into the loose sand faced the contractor for the second runway pavement, but as his price was very low, he could not afford to exceed very much the specified 3-in. minimum thickness. Rollers proved unsatisfactory. Hand rollers failed to give sufficient compression, and power rollers, light or heavy, shoved the mixture around and cracked it to such an extent as to render it useless as a pavement base. The contractor then tried a small crawler tractor for the first rolling, as shown in Fig. 3, and this met the requirements. Good compression was obtained and there was no movement of the base. The

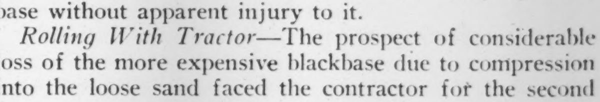


FIG. 5—FLOODLIGHT AND ALIDADE

At left—Floodlight tower with shutter lowered; note ceiling light on roof. At right—Alidade for reading cloud heights.

tractor was kept close to the rakers and was followed almost immediately by a 10-ton tandem roller. A view of the base after one pass of the tractor is shown in Fig. 4. So far as the writer knows, this is a new use for a crawler tractor.

The 2-in. asphaltic concrete surface was placed in the usual manner. About half a gallon of cut-back asphalt per square yard was sprayed over the surface from a spreader truck and stone chips were spread, dragged and rolled in. About ¼ gal. of similar asphalt per square yard was then spread on top of the chips. This final thin film of asphalt seals the chips so they cannot be displaced by tail skids or tires.

When the three runways of the first triangle have been completed, the airport will have 53,400 sq.yd. of paved aprons and a paved runway area of 153,300 sq.yd. Each runway, 150 ft. wide, will be about 2,600 ft. long. The surface between the runways is a tough turf which will be extended as the runways are extended. The paved runways will provide a safe and solid roadway for planes in any season or weather.

Electric Lighting Equipment—All circuits are controlled from a board in the office of the airport master. Two incandescent-lamp field floodlights of the Fresnel lens type are provided, with lamps of 5 kw. and 10 kw. respectively. The latter (Fig. 5) is located about 600 ft. from the control board. Should a lamp burn out, it is swung away automatically and a new lamp swung into place.

Boundary light equipment of a new type will be installed, the special feature being that the lamps will be fed from two series circuits. The rules of the U. S. Department of Commerce do not permit above-ground boundary light circuits in excess of 310 volts, and as any single series loop around a Class 1 airport will exceed this limit, it would be necessary to place a small transformer or safety coil at the base of each light standard. At the St. Paul airport, these appliances and the accompanying underground splicing are eliminated through the installation of two series regulators of 2 kva., each feeding one of the two parallel series. Thus the above-ground voltage will not exceed 260 volts and the installation is more trouble-proof than the single-loop safety-coil installation frequently used.

For the principal beacon the installation is unusual. This beacon is on top of a 110-ft. steel tower situated on the edge of a bluff across the river from the airport and 230 ft. above it. Its light is of the 24-in., 32-volt, 1,000-watt revolving type, with a beam of 8,000,000 candlepower which will be visible 50 miles distant on clear nights. Standard 110-volt obstruction lights will outline the tower and the top of the bluff. An electric clock will turn the beacon light on and off. The high tower was used so that the revolving beam would be high above a psychopathic hospital, in order not to affect the patients. As the main beacon is so unusually high above the airport, it will be invisible with cloud ceilings at less than 340 ft., which occur rarely. A large secondary beacon of the flashing type is provided, therefore, on the port itself, so that any pilot who can get near the port will be able to locate it by means of the secondary beacon.

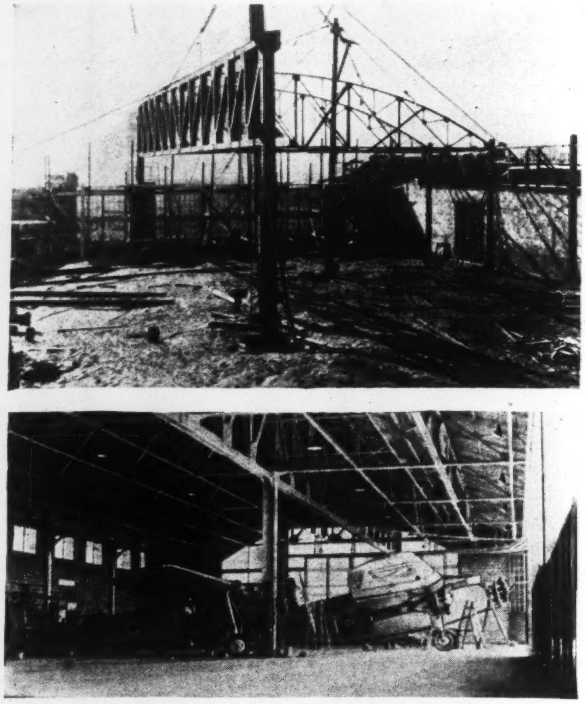


FIG. 7—MUNICIPAL HANGAR AT ST. PAUL

Top view—erecting roof trusses; bowstring trusses will cantilever 28 ft. to left of longitudinal truss. Bottom view—completed hangar; 28-ft. cantilever span of roof at right.

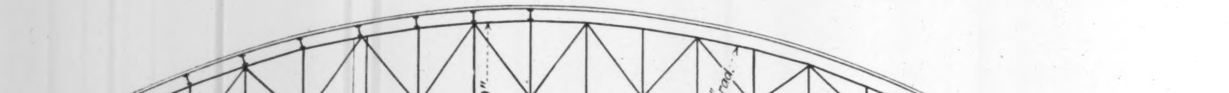


FIG. 6—CANTILEVER ROOF FOR HANGAR

A standard ceiling light is installed on top of the 10-kw. floodlight house (see Fig. 5). Since this is 600 ft. from the airport office, a home-made alidade was installed on the hangar so that ceiling heights can be read direct. The alidade, also shown in Fig. 5, consists of a movable bronze frame fixed on top of a 2-in. pipe. The ceiling light is set at some convenient angle, depending upon its distance from the point of observation. The vertical angle of the sighting bar, trained on the spot of light made by the ceiling light beam on the underside of the cloud stratum, is computed for ceilings up to about 2,000 ft., and these ceilings are marked in feet upon the arc. In use, the ceiling light is turned on from the office control board. The observer steps outside the door, takes a sight at the ceiling spot and reads the indicated ceiling height in feet directly from the arc.

Hangars—One city-owned hangar, which has been in operation since 1927, is of brick and steel construction, 100x100 ft.; 16-ft. vertical clearance and 80-ft. clear opening. It has motor-operated rolling-lift doors, 80x16 ft., which have been fairly satisfactory. This hangar contains a waiting room, a tool and spares room, a small machine shop and a boiler room. The roof, sides and a concrete apron 100x150 ft. are floodlighted for night operation. A second floor over the waiting room contains the airport masters' office and control room and an office of the U. S. Weather Bureau.

A second city-owned hangar under construction is of brick and steel construction, 115x200 ft. It has an opening 22x200 ft., with hand-operated doors running on rails, and contains offices, a pilot's room, a machine shop, shower baths and other facilities. It is of the cantilever type, there being but one post in the entire floor area. The first hangar cost about $30,000; the second will cost about $100,000. One privately owned brick and steel hangar, 115x200 ft., on leased land, has been completed.

In the new municipal hangar, the roof over the main floor is carried by bowstring trusses of 83-ft. span, having the forward portion of 28 ft. cantilevered so as to avoid placing columns in the front wall, which is composed entirely of sliding doors hung from overhead carriers. Two 100-ft. longitudinal trusses supported on the side walls and a central single column carry the bowstring trusses, and this column is the only obstruction in the entire floor area for the airships. In Fig. 7, the top view shows one of the longitudinal trusses and the central column, with parts of the 55-ft. lengths of the bowstring trusses at the right. In the lower view, the 28-ft. cantilevered portion of the roof is at the right.

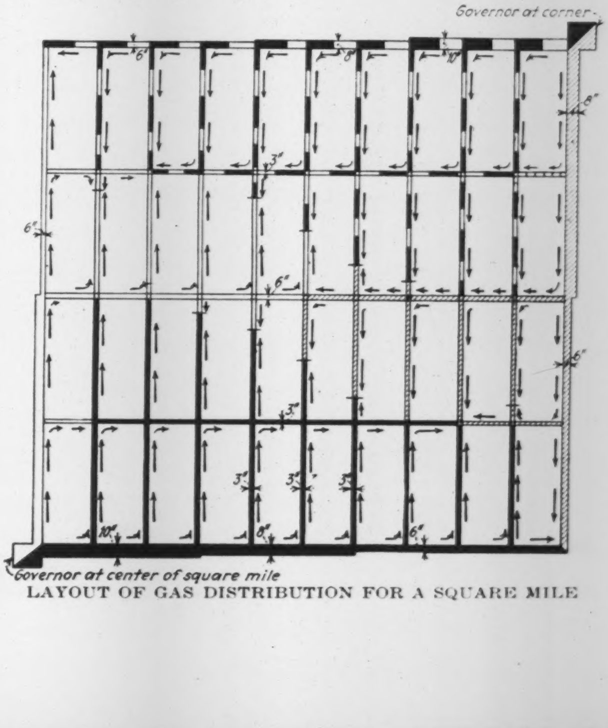
Engineers—The design and construction of the airport are in charge of the city's Department of Public Works, J. H. McDonald, commissioner. Its operation is under the department of public utilities, Otto W. Rohland, commissioner, with Francis J. Geng as airport master. The writer, in his former capacity as superintendent of the bureau of construction in the department of public works, was in immediate charge of design and construction.

Ideal City Gas Distribution for a Square Mile Area

IN ORDER that gas utilities may be able to expand their systems in new territory in a rational manner, the American Gas Association's subcommittee on distribution design, headed by C. S. Goldsmith, has been giving its attention to the design of an "ideal square mile." A report on the subject was presented at the recent meeting of the association. Such "ideal" designs have been made before, but the committee found that the design that has received widest acceptance is uneconomical. In the new design developed for low-pressure distribution, the pipe system contains two governors per square mile, and will distribute 160,000 cu.ft. of gas per hour with a maximum pressure drop of 1 in. of water. This large capacity for such small distributors is in fact made possible by the fact that the sizes of mains are so proportioned that the pressure drop in any block is as nearly as possible equal to the pressure drop in any other block. A further reason for the large capacity of the design is that the gas continually flows away from the governor instead of doubling back on itself. This flow of gas is illustrated by the arrows in the accompanying diagram, which shows a quarter section of a square mile and the assumed gas flow. Calculation of the pressure drop in this square mile was accomplished by assuming a probable gas flow, then checking this assumption by comparing pressure drops at the chosen points of no flow.

The basic assumptions made in designing the system were that the city blocks are one-eighth mile long in one direction and one-twentieth mile in the other; that the gas consumed in the area is taken off at distances apart equal to one-half the length of a short block; and that the total area will consume 160,000 cu.ft. per hour. Trial designs were made having various numbers of governors to the square mile, but the design chosen, having two, proved to be the most economical.

In discussion, it was remarked that in most cities house frontage occurs on only the long blocks and that in such cases the mains in the short blocks could be eliminated, resulting in a further economy of design. Attention was also called to the fact that although the distribution system developed by the committee is an "ideal" toward which to strive, practical considerations make desirable the construction of full-size header pipes to provide for a possibly inoperative governor.



LAYOUT OF GAS DISTRIBUTION FOR A SQUARE MILE

Constructing Large Concrete Conduits for River des Peres Drainage

By W. W. Horner
Chief Engineer, Sewers and Paving, St. Louis, Mo.

Approximately 3.7 miles of the River des Peres stormwater channel being built by the city of St. Louis, Mo., is single and twin conduit of reinforced concrete. While stream diversion and ground drainage had an important place in part of the work and excavation was a large factor throughout, the distinguishing task was the concrete-arch conduit construction. This is particularly interesting because of the sizes of the conduits, the notable speed of construction and the construction devices employed for housing operations and structure against the hazards of cold and storm. All make an exceptional story of planned construction and of unusual and ingenious construction devices. —Editor.

From the end of the open canal in rock to the end of the improvement, a little over 4 miles, a closed conduit was planned. This consisted of single or twin arches of reinforced concrete of the design and dimensions described in the first article of the series and indicated on the project map Fig. 1. The present article describes the construction of reinforced-concrete conduit, first of the twin-barrel type and second of the single-barrel type.

Twin-Conduit Construction

For the first 1,200 ft. the twin conduits were in a narrow right-of-way between the River des Peres and the buildings of a large industrial plant, but the remainder of the two miles traversed vacant property and Forest Park where ample room could be secured for construction operations. As stream diversion was a minor factor in the work, a straight unit-price contract was awarded to A. Guthrie & Co., the second low bidders for $2,296,057. The city's estimate was $3,100,000.

The contractors recognized the difficulties in the first 1,200 ft. where the railroad crossings and the operations of adjacent industries would make rapid construction impossible, and organized this section as a secondary operation, arranging for their main equipment to start north of this section and to have the work so scheduled as to complete the remaining 8,800 ft. within the two years allowed.

Excavating Equipment—For the main operation the excavating equipment consisted of a 300-ton shovel having a 6-yd. dipper with a 90-ft. reach. This shovel, moving on the subgrade, loaded side-dump cars on the natural ground surface adjacent to the trench. These cars were usually operated in six-car trains and were taken either to the backfill area over the finished sewer or to other areas designated as spoil banks. Behind this unit, also in the bottom of the trench, there was a small dragline for rough-trimming the invert and cleaning up loose material in advance of the concrete gang. The material handled by the small dragline was merely moved ahead to within reach of the shovel. The power of the shovel was such that shale, fireclay and even the softer sandstone were handled without blasting. Limestone was encountered for about 600 ft. only, but it materially slowed down the operation.

The subgrade being almost entirely in hard material made it possible to trim the inverts closely and kept the seepage, which was considerable, from hindering progress. Underdrains in the center of each invert were carried ahead of the trimming so that the setting of the invert steel was almost invariably over clean hard ground. A traveling derrick running on the finished inverts took the reinforcing bars from the bank and served the steel setters both in the invert and on the arch forms.

Forms—The inside forms were steel, five 30-ft. sections being provided for each barrel, although in the earlier parts of the main operation two of these sections were in use on the first 1,200 ft. The outside steel forms for the arches were carried by a gantry crane running on tracks, located just outside of the footings. This crane as originally devised also contained the chuting equip-

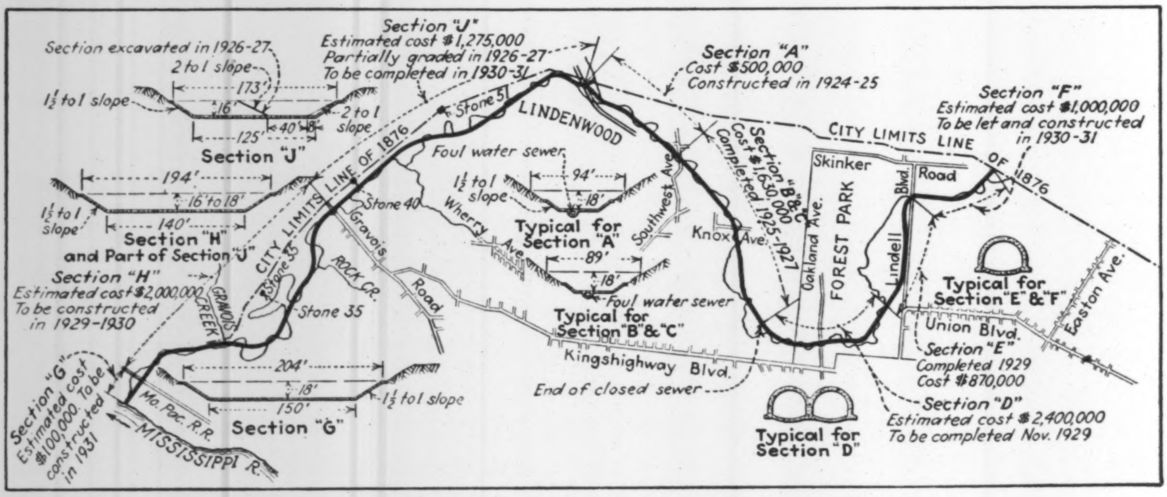

Section excavated in 1926-27
2 to 1 slope
173'
1½ to 1 slope
16'
2 to 1 slope
40'
8'
125'
Section "J"
Section "J"
Estimated cost $1,275,000
Partially graded in 1926-27
To be completed in 1930-31
Section "A"
Cost $500,000
Constructed in 1924-25
Section "F"
Estimated cost $1,000,000
To be let and constructed in 1930-31
194'
16' to 18'
1½ to 1 slope
140'
Section "H" and Part of Section "J"
Section "H"
Estimated cost $2,000,000
To be constructed in 1929-1930
CITY LIMITS LINE OF 1876
Stone 51
LINDENWOOD
Foul water sewer
1½ to 1 slope
94'
18'
Typical for Section "A"
Stone 40
Wherry Ave.
Gravois Road
ROCK CR.
Stone 35
Stone 35
GRAVOIS CREEK
89'
18'
Foul water sewer
Typical for Section "B" & "C"
Southwest Ave.
Knox Ave.
Section "B" & "C"
Cost $1,630,000
Completed 1925-1927
Oakland Ave.
FOREST PARK
Skinker
Blvd.
Road
Lindell
Typical for Section "E" & "F"
Union Blvd.
Easton Ave.
Section "E"
Completed 1929
Cost $870,000
Kingshighway Blvd.
End of closed sewer
Section "D"
Estimated cost $2,400,000
To be completed Nov. 1929
Typical for Section "D"
204'
18'
150'
1½ to 1 slope
Section "G"
Section "G"
Estimated cost $100,000. To be constructed in 1931
Mo. Pac. R.R.
MISSISSIPPI R.

FIG. 1—OUTLINE MAP OF RIVER DES PERES DRAINAGE CANAL

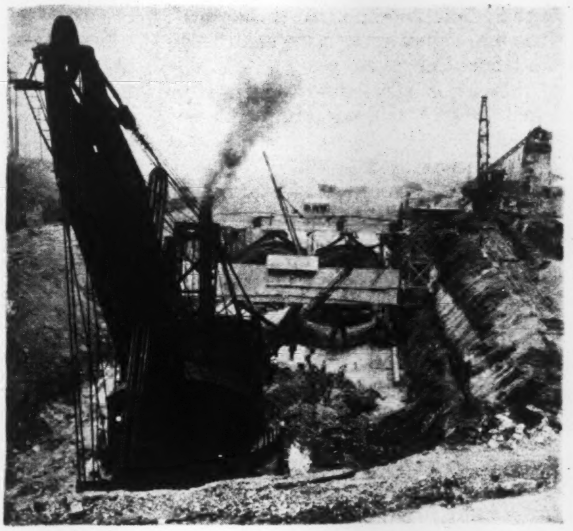


FIG. 2—CLOSE-UP VIEW OF COMPLETE EQUIPMENT SHOWING 600-TON SHOVEL

Note the small dragline immediately behind the shovel which is handling the material removed in shaping the inverts. The invert at this point is in hard shale and fireclay. The two gantries have been covered by roofs so that the work can proceed in bad weather.

ment for distributing the concrete to the arches. A smaller crane of the same type was provided for the concrete chutes serving the inverts.

Concreting Plant—The concreting equipment consisted of a central mixing plant with bins for each of the aggregates and duplicate bins for bulk cement. The permit for the use of bulk cement required careful weighing of the cement for each batch and as a check the carrying of full carloads of cement through the bins as separate units. Generally the batch scales checked the carload weights quite well, but the operation required careful watching. The plant was equipped with a 2-yd. mixer discharging into 1-yd. bottom-dump buckets loading two buckets to the car. This wet-mixed concrete was moved in 6-yd. trains to the edge of the ditch where the buckets were taken off by a locomotive crane and dumped into a hopper from which the concrete moved direct to the invert or to the arch forms. Because of the restriction on the amount of water in the mix, the movement of the concrete in nearly flat chutes was not practicable and belt conveyors were substituted for the horizontal movements from the bottom of the hopper out over the gantries to the distributing spouts.

This equipment was designed to concrete 30 ft. of sewer per day. This involved on the average the removal of about 3,500 cu.yd. of excavation; the placing of 330 cu.yd. of concrete more or less depending on the type of section being built, and the placing of more than 20 tons of reinforcing bars. The value of such a day's unit at the contract price was about $8,000.

In order to make the operation independent of weather conditions the concrete plant was equipped for heating materials and the gantry cranes were roofed over. This is the first case of which we have any record where a sewer was built entirely under roof, the roofs being carried on the backs of the traveling equipment. As will be shown later, lack of progress on this operation was due almost entirely to interferences by road crossings, although occasional extreme cold weather and extensive rains caused some delay.

Progress Records—The first invert behind the big shovel was poured July 18, 1928, and the first arch Aug. 13. The monthly progress was as follows:

Month	Lin. Ft.	Month	Lin. Ft.
Aug. 13 to Oct. 1	740	June, 1929	810
October, 1928	622	July, 1929	610
November, 1928	311	August, 1929	820
December, 1928	630	September, 1929	940
Jan. and Feb., 1929	160	Oct. and Nov., 1929	350
March, 1929	570	December, 1929,	150
April, 1929	560	to Jan. 13, 1930	75
May, 1929	500		

The good record of September and October, 1928, was broken when the crossing at Oakland Ave. in November cut the progress in two. This street had been closed to traffic, but it had been necessary to continue the use of street-car tracks, which were detoured ahead of the work and had the operations badly confined until they could be placed back over the finished sewer. Another record was made in December with 21 out of a possible 30 arches, but usually cold weather and ice-covered ground together with the detouring of the creek and the crossing of Clayton Road prevented any construction between Jan. 4 and Feb. 23. After this time, working conditions improved and the efficiency of the operation increased to the final record of the last full month when a unit was constructed every day throughout September. The work after Oct. 1 consisted in part of a short strip of double sewer but included the construction of the junction chamber. The work in December and January was the building of a short length of single 32-ft. sewer connecting up with the point where section E had been started.

A study of this progress record shows very clearly that where work of this character can be done in the open without interference from cross-traffic ways and at a reasonable distance from the water courses it can be carried out for very low unit cost. It would indicate the propriety in projects of this kind of even more intensive studies of working conditions and possibly of the expenditures of very large sums in order to free the site entirely from such interferences.

The last concrete was poured in March and the com

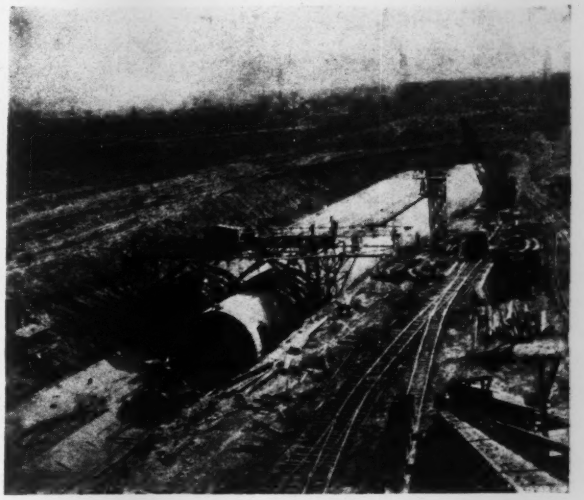


FIG. 3—GENERAL VIEW OF TWIN-CONDUIT CONSTRUCTION

Note the traveling hopper for receiving concrete from the central mixing plant and chuting to belt conveyors on the gantry.

pletion of the backfilling, the restoration of ground surfaces and the removal of equipment was finished in May. The monthly estimate of March 1 was very nearly the final estimate of the work. This showed a total cost of $2,360,000 which is $66,000, or about 3 per cent in excess of the original bid totals. Of this excess, nearly one-third is in special payment items provided for in the contract, but not included in the original canvass of the bids. The remaining over-run is under extra work orders, the greater part of these being outgrowths of the flood on the first 1,200-ft. section.

Difficulties With the 1,200-Ft. Section—The preliminary operation for the first 1,200 ft. was equipped with a 2-yd. dragline excavator and several small draglines. On account of the absence of dumping room in this section a considerable part of the surplus excavation was hauled by trucks. The concreting was done with 2½-yd. mixers and the concrete was sometimes chuted and sometimes buggied.

The work was started on Nov. 15, 1927, and the construction of the retaining-wall section and the erection of equipment took until March, 1928, when the first triple invert was poured. The erection of the new forms required some time and the first arch was not poured until April, 1928. At this time the railway main line was detoured ahead of the work over a double-track trestle and the invert construction had progressed to a point on the railroad right-of-way.

On June 20 an unusual flood occurred in the River des Peres. The river was being carried in its natural bed parallel with the work and generally separated by an embankment of 30 ft. or more in thickness, but at the railroad crossing there was no room for such an embankment, and the contractor had driven steel piling as a protection against floods. This piling was washed out and the whole flood poured through the gap into the head of the unfinished sewers. When the flood subsided it was found that the creek bed had cut down many feet and that thousands of yards of debris from the old bed were packed in and around the forms and nearly filled the finished arches.

The contractor attempted to close the break in the bank with a new line of sheet piling, but a second flood on July 5 carried this away. The gap was finally closed with a rockfill crib and on July 27 the main-line railroad tracks were put back over the finished fill.

Single-Conduit Construction

The single-conduit construction included sections E and F, a little over 2 miles. The design and structure of this 32-ft. arch are described in the first article of this series.

Drainage Shaft on Section E—Being well away from the river and on hard foundations, made it evident that the construction would be relatively simple if the sides of the excavation would stand up on the 1-on-1 slope expected. There seemed to be some reason for worry on this account, as the condition at the starting of section E would be similar to those existing at the start of section A—that is, a new hole would be opened in the valley at a much greater depth than the old creek bed, and a consequent heavy run of groundwater to this low level would naturally be expected, and sloughing of the banks might well result. In order to minimize such a possibility, the writer conceived the idea of attempting to unwater this soil well in advance of the beginning of construction.

For this purpose a shaft about 10 ft. square and heavily timbered was located within 50 ft. of the point of beginning and was carried down about 35 ft. to a point below the top of the shale structure. This shaft

FIG. 4—CLOSE-UP VIEW OF THE TRAVELING EQUIPMENT ON SECTION D
The two gantries are shown closer together than was normally permitted. It was intended that the inverts should set for three days before being heavily worked over.

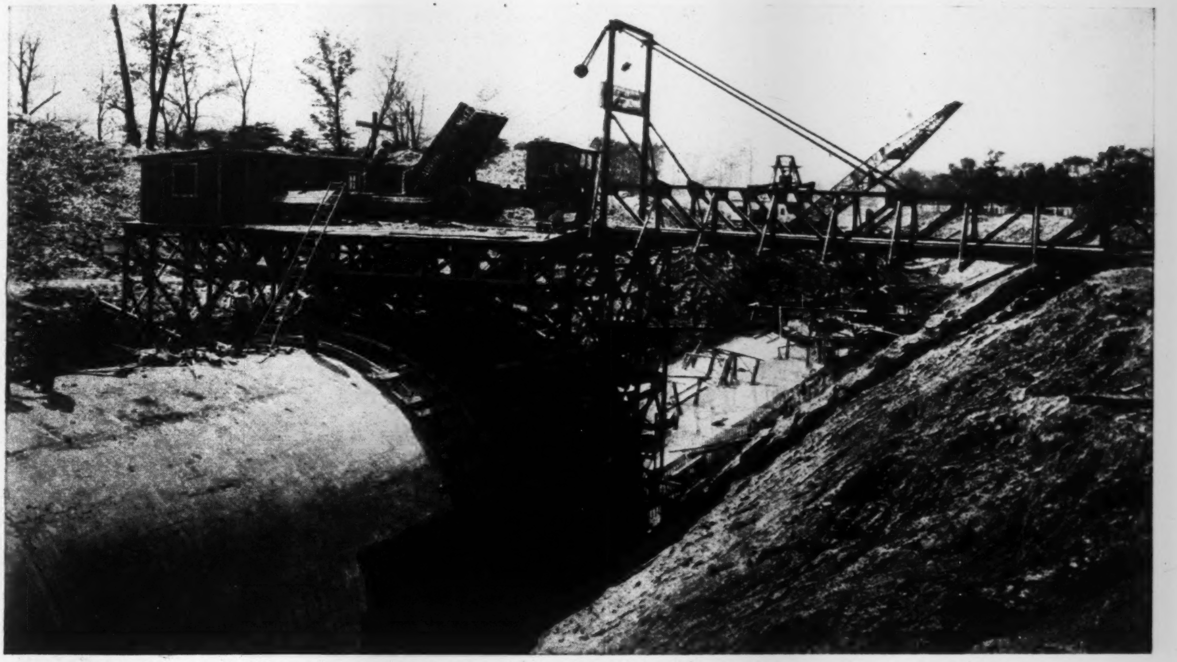


FIG. 5—GANTRY USED ON SECTION E FOR CARRYING OUTSIDE FORMS
It is equipped with a drawbridge which permitted the trucks hauling wet-mixed concrete to back onto the gantry and dump into a central hopper from which the forms were fed by a four-way spout.

was equipped with a $2\frac{1}{2}$-in. electrically operated centrifugal pump. The pump was installed on a platform which could be raised and lowered by chain blocks. From the side of this shaft a 12-in. sewer pipe was laid out extending up the valley about 300 ft. and located just at the top of the shale. This pipe was laid with open joints and was backfilled with rock and gravel so as to afford an easy flow for the groundwater into the pump well. The operation of this pump was started in October, 1928, and for a number of weeks the shaft was pumped out daily, the water rising overnight about 8 ft. About the first of January the frequency of pumping was increased. The shaft was unwatered three or more times each day, so that the water level in the shaft was never allowed to rise over 3 ft.

This intensive pumping was kept up by the city until the site was taken over by the contractor on Feb. 8, 1929, and by him was continued until the main excavation was started about March 10, when larger pumps capable also of handling surface water were substituted. The cost of this preliminary soil drying amounted to less than $5,000 and the effectiveness of the operation in reducing groundwater levels in advance of the main excavation was evident to the engineers and the contractor. Very little sloughing of the banks took place and it was clear that the only possible serious hazard of this contract had been removed.

Special Contract Provisions—The contract was awarded to the W. E. Callahan Co. for $871,232, on a straight unit-price bid. The site of the work being entirely in Forest Park, railroad access would normally have been difficult, but the private property facing the park was laid out in lots of about 600 ft. in depth, the back ends of which were in contact with the railroad. The writer arranged in advance with a citizen who owned one of these pieces of property to lease it to the city for use during construction at an annual rental of 5 per cent on its assessed valuation. The assurance of the use of this property and of the railroad contact at this point definitely simplified the organization of the job.

As the lot lay at the extreme upper end of the section E and also adjacent to the succeeding contract section F, a further option was taken on its use during the construction of section F. As it was evident that the contractor for section E would have to erect an elaborate plant on this lot, is was considered good business to make this plant and equipment available for the succeeding operation under the best possible terms. Accordingly, the contract for section E was written to give the city an option of taking over this plant and equipment at the completion of the section E work for an amount equal to 25 per cent of the original cost. Later the contractor for the succeeding section was to be permitted to take this off the city's hands for the same amount. This arrangement worked out most economically.

Construction Plant—For excavation the contractor again chose a dragline, this time with a 6-yd. bucket. Most of the excavated material was handled by relaying, but the surplus for the lower half of the job was hauled with caterpillar-wagon trains and tractors. Smaller draglines were used for miscellaneous relay work and occasionally for assisting in the main excavation. Later another 2-yd. dragline was brought in to help out with the backfilling.

The contractor set up a well-designed nearly automatic central mixing plant on the private property which had been optioned in advance of the letting. This plant was provided with weighing devices for all aggregates except cement, which was received in cloth sacks in carload lots. Coarse aggregates were discharged direct from cars and elevated to hoppers; a depressed roadway permitted direct discharging into trucks.

The wet-mix concrete was hauled in trucks part way over one of the park roads which was to be removed on account of being in the line of the work, and beyond the end of this road was hauled along a temporary road

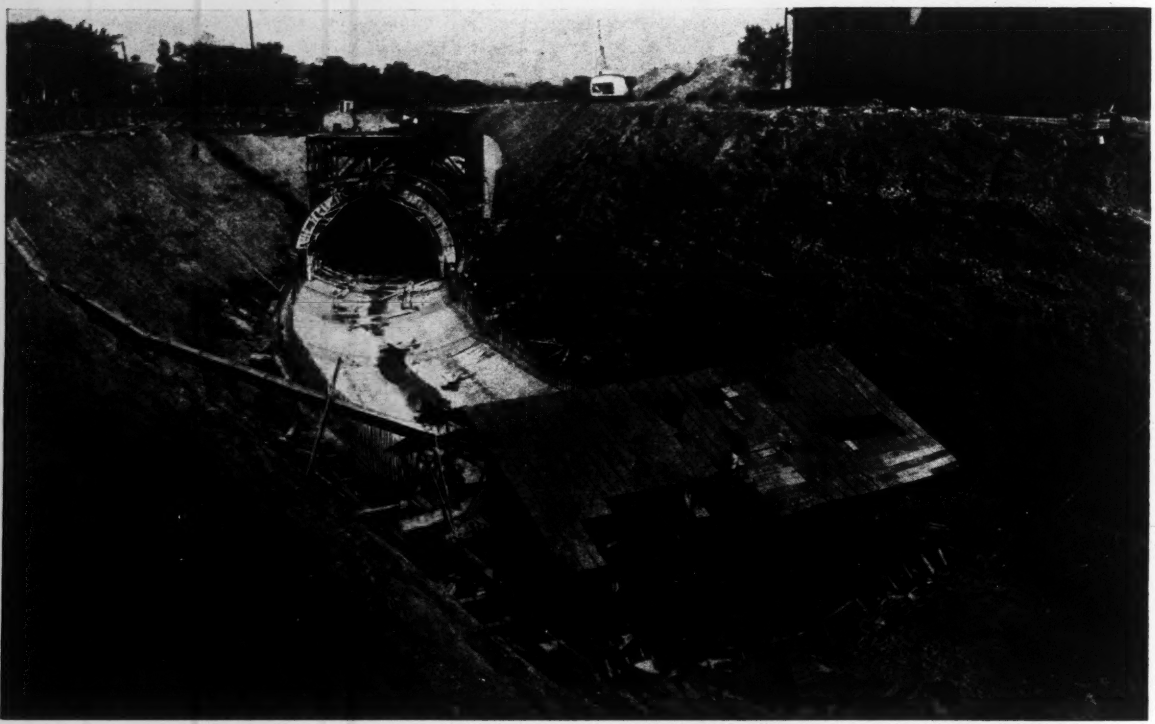


FIG. 6—OPERATIONS IN 50-FT. CUT IN FRONT OF THE JEFFERSON MEMORIAL BUILDING
The gantries have been roofed over so that work can proceed in rainy weather. The bottom of the excavation at this point was in hard shale and some rock.

which the contractor kept cindered and carefully maintained. At the site of the work the trucks were dumped either into a hopper at the top of the side slope for discharge to the invert or were backed out over a drawbridge onto the gantry crane for discharge into a hopper serving the arch.

The work was started on Jan. 21, 1929, the first excavation was done on March 1, and the first invert was poured on March 22. Erecting the forms and travelers required nearly three weeks, the first arch being poured on April 10.

The work was finished considerably ahead of schedule. The actual progress in good months was remarkable, and in September, the same month when the Guthrie company had made its high record on section D, the Callahan company poured 30 consecutive units of 35 ft. each.

Contract Provisions of Section F

The location is in the bed of the River des Peres, which for several thousand feet is a deep artificial gorge through a highly developed apartment-house district. This line crosses under a main-line railroad and heavily used street-railway system, passes through two existing arch bridges and through 280 ft. of existing 32-ft. sewer built at a much higher level. In the case of the arch bridges and the existing sewer the work will consist of lowering the 32-ft. wide channel by deepening in rock to depths of 4 to 15 ft. below the footings of the present structures. In the case of the existing sewer, it will also involve the building of a false arch inside the present arch to make the side wall safe against outside earth pressures. All of this work will be carried on squarely in the creek bed and must be stopped by every rain of appreciable amount.

At the head end of the work a very interesting structure is required to collect the floodwaters of the river and to concentrate them into the mouth of the new sewer. A plot of ground of about six acres will be graded in the form of a large half funnel and the sewer will be expanded by the use of headwalls, retaining walls and slope paving through a distance of 120 ft. to meet the natural contour of the creek bed and adjacent banks. The option in favor of this contractor on the central plant site and equipment provided for the previous section has already been described. In addition to this it was necessary to provide the best possible working conditions and the city arranged to take an option on the 5 per cent per annum basis on each vacant lot adjacent to the gorge through the built-up district. When these are all plotted the available working room would seem to be surprisingly expanded although still averaging not much over 120 ft. in width.

North of the existing Delmar sewer the city owned a considerable piece of property, and arrangements for rather wide working room for equipment and diversion ditches were arrived at with owners of the four remaining tracts. All of the necessary land was put under option on the 5 per cent basis, thus assuring the contractor against any holdup and making it unnecessary for the bidders to investigate private property conditions.

The city's estimate for the work on which bids were taken is $1,120,000 and there was a general item of $30,000 for direct payments to be made on account of work damaged by floods, a total of $1,150,000. Seven bids were received for the project, of which three were less than the city's estimate and one only slightly above it. The work was awarded to the Stiers Brothers Construction Co. on a bid of $940,000, or an expected cost after adding the $30,000 of $970,000—about 15 per cent less than the city's estimate. The work on this contract was started about March 1, 1930.

Engineering Literature

A Monthly Review of Books and a Listing of New Publications

Two Books on Wind Bracing

Reviewed by David Cushman Coyle
Consulting Engineer, New York, N. Y.

WIND STRESSES IN BUILDINGS: With a Chapter on Earthquakes and Earthquake Resistance—By Robins Fleming, Structural Engineer, American Bridge Co. New York and London: John Wiley & Sons, Inc. Cloth; 6x9 in.; pp. 193; halftones, line cuts and tables. $3.50.

WIND BRACING: The Importance of Rigidity in High Towers—By Henry V. Spurr, M.Am.Soc.C.E., Chief Engineer, Purdy & Henderson Co. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 132; line cuts. $3.

NOW THAT the field of the tall skyscraper is being invaded by the strictly speculative builder, the need of a satisfactory method of design for wind loads has become pressing. It is no longer possible to make all the new towers of monumental construction; and if economy of steel is to be demanded, it is vitally necessary to have an idea as to its proper limits. These two books will go a long way toward satisfying the demand for modern theories covering the various forms of wind bracing required in present-day structures.

Mr. Fleming's new book will take the place of his previous volume, "Six Monographs on Wind Bracing," (*Engineering News*, 1915), now out of print, in which he compiled the common theories which served for the design of our earlier skyscrapers. The new book also includes chapters on the various types of wind, and the relation between velocity and pressure, interesting as background, though not, of course, the usual determining factors in design. There are chapters on welding and on earthquake resistance. The principal value of the book, however, will be as a handy reference for engineers who are engaged in the design of moderate-sized buildings, where bracing is needed either for safety or to conform to legal requirements.

Chap. V, on mill buildings, is a valuable discussion of this important class of structures, in which the bracing is used for the simple purpose of preventing collapse. The author's very extensive experience with this type lends authority to his recommendations for assumed loadings under various conditions, as well as to the detailed methods and formulas which he presents. Armories and hangars are also covered under this classification, as they, too, are subject to the danger of being blown away or wrecked by high winds.

In the chapters on many-storied buildings the author treats at length two of his original six methods, the cantilever and the portal theories, which have been adopted by most of the profession for use in ordinary cases. These theories are not applicable to really tall and slender towers. As the author says: "Buildings like the Woolworth and many of the monumental structures now being built or planned are in a class by themselves and require special study." As a matter of fact, the Woolworth was designed by the cantilever method, but owing to the use of 30-lb. load and portal bracing, the problem of vibration solved itself, as it will not do with the modern types of connections. The true field for these "workable" methods is in the ordinary medium-sized building, up to perhaps 30 stories in height with a base of 100 ft. or more. In such buildings the essential requirements are approval of the building department, no interference with the architecture, and simplicity and speed of design and detailing. Economy is no object, as anyone who has ever offset a column in an apartment house knows. Safety is also no object, since experience shows that any respectable design by either of these methods will withstand a hurricane. That being the case, there seems to be little reason for looking further, provided the engineer has had sufficient experience to know the limitations and to keep within them.

Mr. Fleming's treatment of the details to be used with the foregoing methods is much less satisfactory. The details are the real danger point, as it is essential, even in so unimportant a matter as the bracing of an ordinary apartment house, to have some idea whether the bracing is going to develop its face value. If there is a factor-of-two error in the connections, the problem of safety may in some cases cease to be academic. It is easily shown that the values given for connections in Mr. Weiskopf's tables, quoted by the author, are seriously in error, particularly for angles and for four-gage beam stubs. The latter connection was what wrecked the Realty Board Building at Miami. On p. 138 the author also mentions a connection made up of two angles, one inside the other, which he admits is undesirable, "although it accomplished the purpose." The purpose, of course, was to pass inspection; and so long as the shape and size of the building are such that no real wind stresses will occur, this is a perfectly legitimate object. The engineer must, however, know what he is about, and will use the data given in this chapter only where serious bracing is not needed.

In Chap. IX are given diagrams and bracing details for the Lincoln Building. The details show the faults mentioned above, but are justified by the fact that the wide base and the large number of columns render the bracing of this building comparatively easy. Vibration readings in the Lincoln Building indicate that it is stiff, and that the engineer was correct in his judgment; but it would be unwise to take this as a precedent to be followed blindly.

Mr. Spurr's book starts in where Mr. Fleming leaves off, and presents a theory for tall and slender towers, where deflection and vibration are the important factors. In the writer's opinion, this is the first satisfactory method for towers that has been proposed; and improvements will consist largely in refinement of the assumed loadings and allowable deflections, rather than in any radical change in the method itself.

In the absence of any satisfactory test data, Mr. Spurr starts with two assumptions, which will have to do until further experience may suggest modifications. The first is a wind load of 30 lb. at the top of a tower, diminishing uniformly to zero at the bottom. The second is an allowable total deflection "in the steel alone" of 2 ft. per 1,000, or about $\frac{1}{4}$ in. per story. These figures are of course nominal and relative to each other, and do not require checking except by their results.

Keeping this fact in mind, it is then shown that for a "yardstick building," 1,000 ft. high and 100 ft. wide, with ordinary loadings, the deflection due to chord action in the columns will be 1 ft., leaving 1 ft. allowed for "drift," or web deflection. For less slender towers the chord deflection is less, allowing a more flexible bracing system, while for a slenderness ratio of 13 to 1, the chord deflection is $0.0017h$, leaving a permissible drift of only $0.0003h$ in the bracing.

The "cantilever" method of stress distribution is adopted by force—that is, it is assumed that the floors must be kept plane after bending—and the bracing is designed to furnish the shears necessary to produce this result. It is also assumed that the floor must move as a unit without distortion, and accordingly every panel is designed to have an equal drift while applying the required vertical load to the columns. The additional drift due to chord action, being of the next order of magnitude, is disregarded.

That is all, so far as the theory goes. The computations are naturally more lengthy than those of the Fleming methods, but they differ essentially from the slope-deflection computations. The results come along one by one and it is possible always to know just what is being discussed and whether the answers obtained are probable and in line with experience. The vital danger in mathematical processes where one remains submerged until the final result pops out is that some unreal condition or even a slide-rule error may be passed over unnoticed. For practical engineers doing a real building in a hurry, this is important. Incidentally, the "high" methods, in order to avoid overstraining even the professional mind, have to disregard certain factors, such as the deflection of connections and the change in length of members, which in a tall tower are of major importance. A building consistently designed by the slope-deflection theory might have its upper floors seriously out of plane, which would vitiate the whole stress system. Mr. Spurr's treatment, therefore, although somewhat approximate, is closer to the facts than the higher theories for this particular type of case.

In his last chapter Mr. Spurr discusses vibration, which is the important point. Assuming that a gust will perhaps affect a large building 5 per cent as much as the average total wind load, he finds a probable amplitude for the harmonic vibration of 0.1 ft. for his 1,000-ft. yardstick building. For the weights and stiffness assumed, the frequency, which is independent of the force of the wind, would be about twelve beats per minute. The effect of walls and partitions can be roughly gaged, after a building has been built according to this theory, by measuring the frequency, which will be faster than the theoretical by an amount proportional to the added stiffness due to these factors. This is the first practicable method proposed for estimating this influence. And provided a fair judgment can be made of the probable error of the underlying theory, especially if tests show that the floors are holding an even slope, it may produce some results of value.

The original assumptions require the test of experience. The Manhattan Company Building, which was designed by this theory in an earlier form, has been found by the writer to have a frequency of 13½ vibrations per minute, which is not radically different from what one would expect. The amplitude of about 0.1 in. at the 60th floor in an ordinary northwester is also not surprising, considering that Mr. Spurr's figure of 5 per cent is a pure guess. More to the point is the fact that the tests definitely class this building with the Woolworth, the old Metropolitan and other buildings found by experience to be "stiff" in the sense of being comfortable to the tenants. On the other hand, a number of towers designed by other theories, with less conservative types of bracing, have much lower frequencies for their size, and higher amplitudes, some of them actually coming above the threshold of sensation in winds of common occurrence. The indications are, then, that Mr. Spurr's assumed loading and allowable deflection are suitable for use pending further experience, and will produce satisfactory vibration results up to perhaps 800 ft.

It seems fair to say that with the appearance of these two books the bracing of ordinary buildings will be facilitated. And the problem of the slender tower, which was in great confusion a year ago, is now in satisfactory shape for the present.

Valuable Study of Flood Probabilities

Reviewed by Ross M. Riegel

Department Designing Engineer, Department of Public Works, Pittsburgh, Pa.

FLOOD FLOWS: A Study of Frequencies and Magnitudes—By Allen Hazen, Sc.D., Civil Engineer, M.Am.Soc.C.E. New York: John Wiley & Sons. London: Chapman & Hall. Cloth; 6x9 in.; pp. 199; illustrations and tables. $4.

THIS book represents the fruits of study given to the problem of floodflows by the author and his associates during a period of more than twenty years, especially to the relation between their frequency and magnitude. By reason of his recent lamented death, it may be regarded as the author's last word on the subject, entitled to the respect which his standing in his profession commanded.

To quote from the preface: "The object of the present work is to gather in one compact presentation those methods previously published that seem most helpful; some of the basic data arranged in convenient form for reference; to add here and there some scraps of information not elsewhere easily obtainable; and to mix in a little of the author's philosophy in regard to the interpretation of the data and the application of the results." The major part of the book is therefore devoted to the presentation of a method of developing the magnitude of floods of low frequency from existing records of the stream in question and from related records of comparable streams. The method is based on the mathematical theory of probability. The book does not explain the mathematical connection, reference being made to the various pertinent textbooks and papers, especially those published from time to time in the *Transactions* of the American Society of Civil Engineers.

The method used is predominantly a graphic one and is begun by plotting in order of magnitude upon logarithmic probability paper the record of the annual one-day floods of a stream for as long a period of consecutive years as data are available. There is thus obtained an irregular line which affords a value of the mean flood in the recorded period, the degree of variation of floods from the mean and the "skew" quality of the record or the degree of departure from normal probability relations. From this record is developed a smooth curve, of similar mathematical quality as to the three characteristics just enumerated, which may be rationally extended beyond the scope of the record into the zone of low probability on the paper. There is thus afforded a means of estimating the magnitude of a flood which has, say, a 1 in 100 or 1 in 1,000 chance of occurring in any year.

The method appears to be in some degree empirical and to that extent rests upon Dr. Hazen's studies of the records of 109 American streams and the studies of other workers. To the reviewer it appears most directly applicable to larger streams of which a reliable continuous record of, say, 25 to 50 years is available (although valuable results can be obtained from shorter records, particularly by reference to streams of which the topographic and climatic circumstances are analogous). The author admits (p. 122) that there are a number of recorded floods on small areas that cannot be accounted for under his methods (that is, "cloudburst" floods).

The application of the method is illustrated by graphic records of about 30 streams, ranging in catchment area from 102 to 237,000 square miles, which are illustrative of variations between streams and aid in estimating characteristics of other streams which may be under study.

In the remainder of the book the data on extreme floods heretofore published are discussed and it is shown how such data may be utilized to modify and interpret the author's method. The method of estimating floodflow from the study of rainfall as developed in the Miami Conservancy District reports is discussed and recognized as a valuable parallel approach to the subject.

Other chapters are devoted rather briefly to storage, forests and land drainage; obstructions; changes in climate and methods of flood protection. In these the author's "philosophy" is revealed and his comments and mature judgment on certain somewhat controversial phases of these subjects are interesting and significant.

The data and methods presented serve to increase the scope of what may be regarded as demonstrable in the field of forecasting great floods and to reduce materially the area in which judgment only must be relied upon. In the opinion of the reviewer the book is a very valuable one for the student of the problem of great floods, as well as of floods in general.

Researches on Concrete Arch Ribs

DEPENDABILITY OF THE THEORY OF CONCRETE ARCHES—By Hardy Cross, Professor of Structural Engineering. Urbana: Illinois Engineering Experiment Station. Paper; 6x9 in.; pp. 36; tables and line cuts. 20c.

LABORATORY TESTS OF REINFORCED-CONCRETE ARCH RIBS—By Wilbur M. Wilson, Research Professor of Structural Engineering. Urbana: Engineering Experiment Station. Paper; 6x9 in.; pp. 102; halftones, line cuts and tables. 55c.

THESE two research reports on concrete arch ribs make important additions to engineering knowledge. Professor Wilson's tests on hingeless ribs ($17\frac{1}{2}$-ft. span and 4-ft. rise) constitute some of the largest model experiments yet made. In the investigation, measured stresses, both from loads and from abutment movements, were compared with stresses computed by the elastic theory, with gratifying results. Comparison of the strength of the concrete in the arch, which is subjected to axial compression, transverse shear and flexure, with concrete in 6x12-in. cylinders, which in testing are subjected only to axial compression, showed close agreement. Arches of various widths were tested to determine the effect of slenderness ratio upon strength, with the conclusion that the effect can be neglected so long as the ratio of the unsupported length of the arch axis to the width of the rib does not exceed 30. The bulletin gives all test data, curves and tables as well as a complete analysis of the results.

Professor Cross' investigation covered a mathematical study of arch rib action with particular reference to that portion of the total stress (from $\frac{1}{4}$ to $\frac{1}{3}$) whose value stands or falls according to the method of analysis used. This stress in the usual elastic theory depends upon assumptions relative to rotation of arch segments, assumptions that can be correct only by chance. The study indicated, however, that the "departure of the stresses existing in any arch from the values given by the usual methods of analysis can scarcely be greater than the variations in the quality of the concrete, and will most probably be very much less." The report is an excellent analysis of our present methods of designing arch ribs. The investigation was restricted to the bare arch rib and involved no questions of interaction between rib and deck.

For Mechanical Engineering Reference

REVIEWED BY W. A. SHOUDY
Consulting Engineer, New York, N. Y.

MECHANICAL ENGINEERS' HANDBOOK—Lionel S. Marks, Professor of Mechanical Engineering, Harvard University, Editor-in-Chief. New York and London: McGraw-Hill Book Co., Inc. Flexible binding; $4\frac{1}{2}$x7 in.; pp. 2,264; over 1,300 illustrations and diagrams. $7.

PROFESSOR MARKS' handbook needs no introduction to the engineering public, for since its first edition it has been one of the standard reference books for mechanical engineers. This third edition, therefore, will be cordially welcomed.

Six years have passed since the second edition, and these years have witnessed a rapid change in mechanical engineering practices. There has been a marked tendency toward increase in size of equipment, in the adoption of new alloys permitting of increased speeds. In the power field, steam pressures and temperatures have increased so rapidly as to require revision in steam data and standards. Welding, which was largely in an introductory stage at the time of the second edition, is now actively used in machine construction, and the electric furnace has become a common piece of equipment. All branches of engineering are paying more attention to fundamental data, and new designs are being worked out from the ground up. The handbook today must therefore contain more than dimensions and standards; it must be largely fundamental data and formula.

Professor Marks has apparently borne this condition in mind, for the third edition appears to be largely rewritten. About 30 new authors are listed, and one new section has been added. Possibly the term "rewritten" is too strong, because the book has the same familiar appearance. It is a credit to Professor Marks' foresight that after fourteen years of rapid development in engineering, it has been necessary to make so small a change in the form of the handbook.

Among the welcome additions are the chapters on Dimensional Analysis, by Prof. P. W. Bridgeton; that on Transmission of Heat by Convection, Conduction and Radiation, by Prof. W. H. McAdams, and Vibration Problems, by Prof. S. Timoshenko. Fuels and Furnaces appears as a separate section, now made to include high-temperature and low-temperature carbonization of coal, as well as considerable information on industrial furnaces. The section on Power Generation has not been changed in form but has been greatly extended to bring it up to 1930 practices. The chapter on Cost of Power has been written by George A. Orrok, and is particularly welcome at this time when this subject is under public discussion. Among the other chapters that appear to be rewritten are those on Building Construction, Machine Shop Practice and Electrical Engineering.

The reviewer has one small disappointment. He is sorry to see the condensed "contents" sheet. In the form used in the first edition it was of particular value when the exact title of the heading was unknown.

Mine Surveying

METALLIFEROUS MINE SURVEYING—By Thomas G. Hanton, Bachelor of Engineering (Mining and Metallurgy), University of Sydney, Member of the Australasian Institute of Mining and Metallurgy. Stationers' Hall Court, Ludgate Hill, London: Crosby Lockwood & Son. Cloth; 6x9 in.; pp. 224; tables and text illustrations. 15s.

FROM first principles of surveying through much of ordinary field practice to the more difficult problems of underground work is the rapid pace maintained by the author in his 215 pp. Almost half of the book deals in a most thorough manner with the ordinary instruments used and their care. With this foundation, after some space devoted to office practice, the actual surveying problems, both above and below ground, are considered. The portion dealing with mine work shows evidence of the author's practical experience in the solution of problems. More illustrations in these chapters would have been welcomed. A short chapter is devoted to bore-hole surveying. The book is practical and readable and contains only a nominal amount of mathematics; there are no tables.

Water in the Arid West

Reviewed by F. W. Hanna

Chief Engineer and General Manager
East Bay Municipal Utility District, Oakland, Calif.

WATER SUPPLY AND UTILIZATION: An Outline of Hydrology From the Viewpoint of the Arid Section of the United States, Together With an Outline of Water Law and Its Administration as It Has Developed in the Arid States—By Donald M. Baker, M.Am.Soc.C.E., Consulting Engineer, and Harold Conkling, M.Am.Soc.C.E., Deputy State Engineer of California, Formerly Engineer U. S. Bureau of Reclamation. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Cloth; 6x9 in.; pp. 495; line cuts and tables. $6.

THE SUBJECT indicated by the title of this book is discussed and analyzed for the area usually known as the arid West, comprising essentially sixteen states in the western part of the United States. For this reason the book will be of particular interest to engineers and residents of those states. However, the principles set forth are of such general application as to be of almost equal interest to engineers and laymen elsewhere.

The book is arranged in seventeen chapters, starting with an introductory one, followed by others on Climatology, Precipitation, Disposition of Precipitation, Evaporation, Transpiration, Streamflow and Runoff, Water Rights in Surface Streams, Determination of Available Water Supply, Groundwater Hydrology, Groundwater in Alluvial Deposits, Water Rights in Underground Water, Purposes for Which Water Is Utilized, Conflict and Correlation Between Uses of Water, Administration of Streams, Valuation of Water Rights, and Quality of Water.

The authors have made the treatise quite comprehensive of the general subject matter covered by the title of the book, as well as those of the individual chapters, and as a result the book contains much academic material. However, this is excusable on account of the all-inclusive nature of the work, and, in fact, it adds greatly to the value of the discussion. Practicing engineers will be particularly interested in the chapters on Evaporation, Transpiration, Water Rights in Underground Water, Administration of Streams, and Valuation of Water Rights. The collection of the material on this subject in a single book gives a comprehensive and definite single source of information that is of considerable value to the busy reader. A large part of the material in the book has been compiled from various state and national reports, papers and publications. This material has been wisely selected and digested.

There are a few errors in the text such as that on p. 90, where the constant *A* is omitted from the evaporation formula, and that on p. 344, where the arrow that was intended to point to the water plane line in Fig. 2 is pointed to the ground surface line instead. However, for a first edition of large volume, the book is relatively free from errors. It should be in the library of every practicing civil engineer, and of all others interested in water supplies, including attorneys, financiers and public officials.

Economic Aspects of Engineering

Reviewed by John H. Gregory

Consulting Engineer, Professor of Civil and Sanitary Engineering,
Johns Hopkins University, Baltimore, Md.

PRINCIPLES OF ENGINEERING ECONOMY—By Eugene L. Grant, A.M., C.E., Professor of Industrial Engineering, Montana State College. New York: The Ronald Press Co. Cloth; 6x9 in.; pp. 387; 12 line cuts. $3.75.

THE RECENT survey by the Society for the Promotion of Engineering Education brought out the fact that among engineering graduates there is a general feeling that the most serious omission in their technical education was the failure to emphasize the economic aspects of engineering, and in the preface the author states, in this connection, that what the engineering student needs most of all is a point of view—the point of view that ultimate economy is a problem with which the engineer must be concerned. Assuming, then, that the principles of engineering economy are to be emphasized in the training of engineering students, the reviewer agrees with the author that, in general, the underlying principles may be best presented in a separate course. This book has been prepared as a text for such a course.

The subject matter has been treated under three heads: The Arithmetic of Engineering Economy, comprising nearly half of the book; Fact Finding in Economy Studies; and Background for Economy Studies. Ten pages are devoted to Review Problems, and 7 pp. to the Index. At the end of many of the chapters illustrative problems are given. These are arranged for use by diversified groups of engineering students as early as the third year of their course, and are mainly of such a nature as to be adapted to and readily understood by students from any branch of engineering. Also, 161 selected references are given, mainly titles of books.

That the engineer should bear economy in mind goes without saying, but economy must be tempered with judgment. In certain branches of engineering, especially in industrial engineering, economy may be the sole or controlling factor, whereas in other branches, while economy should not be lost sight of, architectural treatment may be the controlling factor. For example, a steel bridge may be more economical than an arched one, but would many engineers build a steel bridge across the Potomac River as an approach to the Lincoln Memorial at Washington even if it were more economical? And, again, would a factory type of building, certainly adequate for the purpose, be erected to house pumping machinery in a beautiful park, as at Chestnut Hill reservoir in Boston or in Druid Hill Park in Baltimore? These examples may be extreme, but the reviewer, in many years' practice, has seen examples where allowing economy to be the controlling factor has been folly. And so, in training a student in the principles of engineering economy, he must not be permitted to gain the idea that ultimate economy is always the controlling factor. The author points this out in the text, but some phases of the subject might be more strongly emphasized.

The book is an interesting one, and although primarily for students of engineering, many practicing engineers will be well repaid for the time spent in reading the text as well as the problems.

Publications Received

Better Late Than Never applies to many federal and state publications. In this class is Stream Flow Records, Pennsylvania, for the Water Year Ending Sept. 30, 1927 (Water Resources Service, Department of Forests and Waters, Harrisburg, Pa.). Presumably the delay in publication is not the fault of the department named.

The ASA Bulletin, "the membership publication of the American Standards Association" (29 West 39th St., New York City), is now being issued in printed form. It records not only the activities of the association but also, according to Arthur Kallet, ASA Information Service, "all other important developments in the field of industrial standardization and specification work both in the United States and abroad."

Safety on the El is the catch title given to a handsomely made illustrated book which embodies the Boston Elevated Railway's successful entry for the Anthony N. Brady gold memorial safety medal for the year 1928. Among the main topics is one on Methods, Devices and Engineering Practices Conducive to Increased Safety, Reduced Maintenance and Greater Reliability, and another on Measures to Promote Safety and Health of Employees. An appendix is entitled Continued Progress During 1929. (Boston Elevated Railway, Boston, Mass.)

The Eads Bridge across the Mississippi River at St. Louis, built in 1867-74, was long and rightly considered a great achievement in bridge engineering. Its history, design and construction were described by the late Calvin M. Woodward in a volume published in 1881 (A History of the St. Louis Bridge. Cloth; 10½x13½ in.; nearly 400 pp. of text and woodcuts and 50 full-page lithographed and artotype plates). Those interested in the history and triumphs of bridge engineering who do not possess the book will be glad to know that a few copies of it are for sale by the daughters of the author. They may be obtained for $8 each, carriage extra, from Miss Grace M. Denison, Washington University, St. Louis, Mo.

So Scarce and generally inaccessible is information regarding the pioneers of the engineering profession in the United States that any contribution to the subject is welcome—doubly welcome when so well written as is the paper on Some Early American Civil Engineers and Surveyors, read before the Connecticut Society of Civil Engineers in February of this year by Richard Shelton Kirby, associate professor of engineering drawing, Yale University, New Haven, Conn., and since reprinted from the 1930 *Proceedings* of the society. In 22 pp. the author gives a review of early engineering and surveying in this country and then sketches the activities of David Rittenhouse, John C. Senf, Andrew Ellicott, Robert Fulton, William Weston, Christopher Colles, Thomas Paine, James Finley, Theodore Burr, Benjamin H. Latrobe and the Loammi Baldwins, father and son.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

THE ADMINISTRATION OF THE GASOLINE TAX IN THE UNITED STATES—By F. G. Crawford, Professor of Political Science, School of Citizenship and Public Affairs, Syracuse University. (Revised Edition.) 261 Broadway, New York: Municipal Administration Service. Paper; 6x10 in.; pp. 35; tables. 35c.

Besides bringing the earlier data to date, this edition contains "material showing how the tax is distributed" among local units of government.

AERONAUTICAL METEOROLOGY—By Willis Ray Gregg, A.B., Fellow Am.Met.Soc., Fellow Royal Met. Soc., Principal Meteorologist in Charge of Aerological Division, U. S. Weather Bureau. With the Collaboration of C. G. Andrus, R. N. Covert, H. M. Hightman, V. E. Jakl, D. M. Little, R. W. Reichelderfer, J. A. Riley and R. H. Weightman. Second Edition, Revised and Enlarged. New York: The Ronald Press Co. Cloth; 6x8 in.; pp. 405; halftones, line cuts and tables. $4.50.

Revised to include progress since first edition appeared four years ago. Fogs now have a separate chapter. Chapter on Clouds enlarged and renamed Ceiling and Visibility. Two chapters on Airship Meteorology and one on Ice Formation on Aircraft added.

AMERICAN CIVIC ANNUAL: A Record of Recent Civic Advance, With a List of Who's Who in Civic Achievement—Edited by Harlean James, Executive Secretary, American Civic Association. Vol. II. Washington, D. C.: American Civic Association, Inc. Cloth; 5x8 in.; pp. 340; halftones and tables. $3.

Mostly short papers by well-known civic workers, landscape, city planning and engineering specialists grouped under four topics: The Nation, including national parks, housing and the federal city. Regional Planning: Work in the States—parks, famous highways, capitols and roadside improvement. Cities and Towns—planning civic improvement, notable public structures, and "planned college campuses" at Stanford and Illinois universities.

A BRIEF SURVEY OF RAILWAY TAXATION—Washington: Bureau of Railway Economics. Paper; 6x9 in.; pp. 28; line cuts and tables. Free on request.

ECONOMICS OF WORLD PEACE: Including a Supplement on Foreign Land Problems—Being pp. 1-293 of the Annals of the American Academy of Political and Social Science for July, 1930. Paper; 6x9 in.; tables. 3622 Locust St., Philadelphia. $2.

A symposium under six heads: Population Growth and Migration of Peoples, International Transportation and Communication, Foreign Investments, Competition for Raw Materials, Commercial Policies and Tariffs, An American Economic Policy. An appendix deals with Economic Tendencies Affecting the Peace of the World. In the Supplement on Foreign Land Problems there are, among others, papers on Municipal Housing Development in Vienna and Development of Polish Cities in the Period from 1918 to 1930.

ENGINEERING [Our Debt to Greece and Rome Series]—By Alexander Purves Gest, C.E., Rensselaer Polytechnic Institute. New York: Longmans, Green & Co. Cloth; 5x7 in.; pp. v-xiii + 221. $2.

ESTIMATING CONSTRUCTION COSTS—By G. Underwood, Construction Engineer. New York and London: Mc-Graw-Hill Book Co. Flexible; 6x9 in.; pp. 620; halftones, tables and many line cuts. $6.

LE PORT DE NEW-YORK DANS SON ROLE ECONOMIQUE—Par Gaston Euskens, M.S., Docteur en Sciences Commerciales Lecencie en Sciences Poltiques et Sociales. Louvain: Rene Fonteyn. Paper; 6x10 in.; pp. 395; tables. $5.

MUNICIPAL ORGANIZATION FOR STREET TRAFFIC CONTROL—By Miller McClintock, Director, The Albert Russel Erskine Bureau for Street Traffic Research, Harvard University, and Sidney J. Williams, Director, Public Safety Division, National Safety Council. 261 Broadway, New York: Municipal Administration Service. Paper; 6x10 in.; pp. 28; line cut and folding chart. 35c.

Dr. McClintock "discusses the technical, engineering factors in traffic control, and describes briefly municipal traffic-engineering organizations," and Mr. Williams presents "a picture of the organization and work of the traffic divisions of our police departments, and of the new traffic courts and quasi-judicial agencies which have been created to handle traffic prosecutions." There is a bibliography.

NOUVILLE MÉTHODE PRATIQUE ET TABLES POUR LE CALCUL DU MOUVEMENT DES TERRES et de la Zone d'Emprise Nécessaire à la Construction de Routes, Voies Ferrées, Canaux—Par G. Catto, Traduit de l'Italien par O. Bourgeois, Professeur au College Stanislas. Paris: Dunod. Paper; 5x8 in.; pp. 250; tables and text illustrations. 32 fr.

Earthwork tables in metric units translated into French from the Italian. The method consists, in general, in taking transverse sections at suitable intervals, assigning a mean inclination to the existing ground slope, and obtaining excavation values from the tables for values of height or depth of fill or excavation and transverse slope, multiplied by the distance between sections.

WILLIAM L. SIBERT, THE ARMY ENGINEER: Major-General, Retired; Builder Gatun Locks and Dam, Panama Canal, etc.; Chairman of Board to Determine Economic and Engineering Feasibility of the Boulder Dam Project—By Edward B. Clark, Colonel, United States Army, Res. Philadelphia: Dorrance & Co., Inc. Cloth; 6x8 in.; pp. 206; 16 halftones. $2.50.

STRENGTH OF MATERIALS—By S. Timoshenko, Professor of Engineering Mechanics, University of Michigan. Part I: Elementary Theory and Problems. New York: D. Van Nostrand Co., Inc. Cloth; 6x9 in.; pp. 368; text illustrations. $3.50. Part II: Advanced Theory and Problems. Cloth; 6x9 in.; pp. 735; text illustrations. $4.50.

STUDIES AT THE SEWAGE TREATMENT PLANT, THE PENNSYLVANIA STATE COLLEGE—Bull. 36 of the Pennsylvania State College Engineering Experiment Station, State College, Pa. Paper; 6x9 in.; pp. 51; text illustrations, and folding tables and plates.

Includes a 6-p. paper on A Comparison of the Efficiency of Open and Closed Trickling Filters, by Elton D. Walker, head of department of civil engineering and professor of hydraulic and sanitary engineering; 21 pp. on A Comparative Study of the

Biology of the Open and Closed Sprinkling Filter of the Pennsylvania State College, by Glen A. Lindsey, instructor in engineering research (a co-operative study joined in by the Chemical Foundation); and 20 pp. on Protozoa Found in the Sewage Disposal Plant at the Pennsylvania State College, by Philip M. Jones, graduate student.

THE THEORY OF EXTERNAL LOADS ON CLOSED CONDUITS in the Light of the Latest Experiments—By Anson Marston, Director, Iowa Engineering Experiment Station. A Highway Investigation Conducted at Ames, Iowa, by the Iowa Engineering Experiment Station in Co-operation with the United States Bureau of Public Roads. [Reprint of a paper read before the Highway Research Board, Dec. 12, 1929, and included in its *Proceedings.*] Ames, Iowa: Iowa State College. Paper; 6x9 in.; pp. 36; line cuts and tables.

Brief but comprehensive summary of 21 years of study by the author and many associates, resulting in "a complete mathematical theory of external loads on closed conduits and of the supporting strengths of pipe conduits" *applicable to "all kinds of closed conduits and to all classes of field conditions of conduit Construction."*—Italics ours—EDITOR *E. N.-R.*]

THE USE OF COPPER SULPHATE IN CONTROL OF MICROSCOPIC ORGANISMS—By Frank E. Hale, Ph.D. Revised. New York: Nichols Copper Co. Paper; 6x9 in.; pp. 31; halftones, line cuts and tables.

Letters to the Editor

"Sluice-Head" a Hydraulic Unit

Sir—"Random Lines" of March 6 gives some publicity to the term "sluice-head" as an Australian curiosity in water measurement. In Tasmania this unit is in regular use and is legally defined as the flow through an orifice of certain size under a certain head, equal to 24.168 cu.ft. per minute or, more conveniently, about 0.4 sec.-ft. Other Australian states have the same term in use, but I do not know whether it refers to the same quantity or varies from state to state like the miners' inch.

As far as I know, *Engineering News-Record* is the first outside publication to discover the term.

Hobart, Tasmania, A. P. FLOCKART,
June 5, 1930. Hydraulic Engineer.

Fundamental Problem for the Engineer

Sir—The editorial on "A House-Building Industry" in your issue of June 12 was welcomed by one who for many years has been endeavoring to impress upon fellow engineers the need to take a greater interest in a social problem, which, as you very plainly indicate, is essentially an engineering problem. However great may be the need for improved methods of constructing houses and better methods of financing the cost, the fundamental problem for the engineer to attack is the planning of the site and reduction of cost of street works and public utilities. Mass production and the reduced cost of automobiles would avail little if roads and streets had been left in the state that served ox-teams and stagecoaches. Cheap houses will be only a snare to entangle many if they are to be used as a bait by real estate gamblers. What is most needed on this continent is the removal of the home from the field of speculation and placing of housebuilding on the basis of a sound investment, so that, as in England, building societies, primarily interested in securing a legitimate profit for those that invest with them, will be willing to advance as much as 90 per cent of the cost of a small home to one who builds for use and not for speculation.

The review in your issue of June 19 of "Towards Civilization," edited by Charles Beard, may also serve to draw the attention of engineers to some of the problems of the machine age. Stuart Chase, in a review of this book, said, "What we want from engineers is courage, imagination, and above all social responsibility." Your reviewer appears to wish to place the responsibility on other than engineers, but if engineers accepted a larger share and, as stated, "give to housebuilding the thoughtful planning and technical foresight that they have lavished on other branches of industry, a remarkable renaissance would soon be under way."

At this time, when many industries are under depression and many engineers unemployed, is it not opportune to give attention to the long-neglected problem of the proper housing of the common people? A. G. DALZELL,

Toronto, Ont., President, Town Planning Institute
June 30, 1930. of Canada.

Old Buildings Should Undergo Inspection Regularly

Sir—I have noticed that you refer editorially to the collapse of many old buildings. There are numerous causes for these buildings collapsing and it may be either a combination of all or one:

1. Movement of soil as a result of subway excavation in the neighborhood of the structure.
2. Dry rot in wooden pile foundation due to lowering of water table.
3. Overloading and changing the use of building.
4. The materials used for laying of brick or stone work changing through age.
5. Bearing capacity of brick walls or stone work changing by age, as a result of the cement (if any used) deteriorating.
6. Placing heavy loads in the center of spans, thus overloading floors.
7. Removing partitions that may have been originally designed for bearing.
8. Alterations made without architect and engineer.
9. Vibrations of areas within subway cuts.

An example of this condition was exposed to the writer at the time he built the Public Theater, at Second Ave. and Fourth St., New York. When the buildings were torn down for the theater property, inspection of the foundation walls of the building to the east of our property disclosed a horrible condition of a foundation wall having been put together without any filling between the stones. Either the builders failed, 30 years ago, to lay up the rubble wall with the proper materials or time has permitted the materials to seep out. Conditions of this kind exist in many buildings and they are held up merely by leaning upon the buildings surrounding them.

I am in favor of a periodic examination of many of these old buildings. They not only endanger the lives of those working in them but also people in the street. While this may be a hardship on the bureau of buildings, still the city of New York should increase the force with a sufficient number of men to make these periodic examinations.

New York, N. Y., DAVID M. OLTARSH.
June 27, 1930.

Regulation of Traffic an Engineering Problem

Sir—Your editorials in the issue of July 17 advocating the idea that regulation of traffic is an engineering problem rather than a matter for police regulation is very much to the point.

I recall an incident in connection with the development of a highway project of some importance in a large Eastern city when at a hearing before the mayor and heads of the departments mention was made of this same idea. The mayor immediately took issue. He said: "Now, we don't want no advice in this town about handling traffic from no experts. When we wants traffic to move, a police officer tells them they can go and when he says 'Stop' they stops, and he can do that better than any engineer. Let yer engineers build the bridges and put down the pavement and the police department will git the traffic over it." So that particular expert knew where he got off.

In spite of this very generally accepted idea, however, among our municipal governing bodies, there is no doubt that they will have to turn to the engineer for any real solution of the troubles that are piling up. Some municipalities and states have already realized this, as, for example, the State of New Jersey, the city of Detroit and some others. The city planner is coming into his own, but the handling of traffic is a matter for engineers especially skilled in matters of transportation—generally speaking, those who have had experience in lessening the resistance to traffic on our railways and who realize the importance of all the factors, especially those of time and cost.

FRED. LAVIS,
New York City, President, International Railways
July 22, 1930. of Central America.

News of the Week

Chicago Subway Plans Delayed

Legal disputes over the validity of ordinances passed by the Chicago city council in appointing the board of engineers for the proposed rapid transit subway are delaying the preparation of plans and preventing payment of the engineering staff. In view of this situation the staff is not being increased, as had been intended. The main dispute is over the legality of the appointment of the board of engineers noted in *Engineering News-Record* of July 10, p. 71, and until this is settled the city comptroller is withholding payments. Some of the city's attorneys hold that the method of appointment was illegal, and the corporation counsel has asked the lawyers of the rapid-transit board for their opinion before rendering his decision.

Consulting Engineers Named for International Water Commission

W. E. Anderson, of San Benito, Tex., and Louis C. Hill, of Los Angeles, Calif., have been appointed by the State Department as consulting engineers on the American section of the International Water Commission, United States and Mexico. Mr. Anderson is a former commissioner of this country on the International Water Commission. Mr. Hill has been retained on a number of occasions by various branches of the government to carry out important engineering work in the vicinity of the Mexican border.

The department announces that Karl F. Keeler, of Provo, Utah, who has been attached to the American section of the commission as an engineer since June, 1928, will continue his services as associate engineer, with headquarters at El Paso, Tex.

Engineering Courses Reorganized at University of California

Under a reorganization of the engineering colleges of the University of California, the interests of civil, electrical and mechanical engineering will be administered by the faculty of a college of engineering, of which Prof. Charles Derleth, Jr., has been appointed dean. The college of engineering will conduct four-year curricula separately in civil, electrical and mechanical engineering, each leading to the B.S. degree.

By administering these engineering groups by one faculty, with one dean, it is intended to offer to students the option to remain more than four years, thereby combining to a fuller degree simultaneous studies in civil, electrical and mechanical sciences. In this way students may remain five years or even six years, receiving the B.S. degree in a combination of engineering subjects.

Drought-Stricken States to Obtain Relief From U. S.

Immediate Apportionment of Federal Funds for Highways to Be Made by Secretary Hyde

THE FIRST step taken by the federal government in affording relief to those states afflicted by the drought was the action of Secretary of Agriculture Hyde authorizing the immediate apportionment of $121,875,000 of federal funds for highway improvement in the several states for the next fiscal year. Under usual procedure the funds would not be allocated until Jan. 1 next.

States to Advance Road Building

The action of Secretary Hyde will enable the states to advance their road-building programs and provide employment for farmers whose crops have been destroyed by the drought. Each state must appropriate for the same work an amount equal to that received from the federal government.

In this connection the Bureau of Roads has called the attention of the states to the fact that many of them at present have large balances of federal-aid money against which they may draw at any time they have complied with the regulations with regard to the approval of highway projects. On Aug. 1, $65,256,147 of federal money was being held in the Treasury waiting to be matched by state funds. All of that amount can be disbursed immediately. The $121,000,000 cannot be disbursed until after July 1, 1931, but with the formal allocation of the money the states are permitted by law to let contracts in advance. The allocation becomes a contractual obligation of the United States. Even if the state is not in a position to finance payments under these advanced contracts, the contractor in most cases is able to make the necessary financial arrangements because of the absolute certainty that the money will be forthcoming on July 1, 1931.

While contracts against next year's funds will not be approved except in districts where unemployment has been increased by the drought, it is expected that this will be interpreted liberally. Many states will not be able to take advantage of this allocation, as they have no unsold bonds or authority to borrow. The Illinois highway commission already has notified officials in Washington that it has ordered the sale of $4,000,000 of state bonds so as to take advantage of the early allocation.

States Set Up Agencies

The governors who attended the conference called by President Hoover have reported that they have set up state committees to co-ordinate the work of the federal, state and county agencies

"SILVER" BRIDGES AT PITTSBURGH'S GOLDEN TRIANGLE

Three bridges of identical design, spanning the Allegheny River and serving Pittsburgh's business district at Confluence Point, are receiving coats of aluminum paint. Of the two bridges shown in the illustration, the one in the background, not yet repainted, received first prize in 1929 from the American Institute of Steel Construction for excellence of design, and served as a model for two sister bridges directly upstream. The paint used is standard with Allegheny County for highway bridges.

administering relief. President Hoover asked them first to name a financier member of their state organization. The President purposes to call these men to Washington at once to set up the credit mechanism through which the federal financial agencies will co-operate.

The Treasury will pay cash to the states according as each shows progress of its road projects by construction reports.

Allocations to the States

Although emergency road work is expected to be done in only those states suffering from unemployment and from the drought, the apportionment included all the states, and is as follows:

State	Amount	State	Amount
Alabama	$2,615,434	Nevada	$1,598,987
Arizona	1,768,023	New H'pshire	609,375
Arkansas	2,174,786	New Jersey	1,565,749
California	4,181,212	New Mexico	1,984,363
Colorado	2,315,948	New York	6,002,475
Connecticut	793,359	N. Carolina	2,871,722
Delaware	609,375	N. Dakota	2,001,841
Florida	1,543,232	Ohio	4,584,440
Georgia	3,316,029	Oklahoma	2,922,569
Hawaii	609,375	Oregon	1,997,569
Idaho	1,554,594	Pennsylvania	5,517,738
Illinois	5,150,396	Rhode Island	609,375
Indiana	3,172,253	S. Carolina	1,769,848
Iowa	3,330,593	S. Dakota	2,054,077
Kansas	3,397,874	Tennessee	2,687,123
Kentucky	2,356,367	Texas	7,620,239
Louisiana	1,745,445	Utah	1,416,493
Maine	1,121,860	Vermont	609,375
Maryland	1,051,714	Virginia	2,379,788
Massachus'ts	1,813,916	Washington	1,940,922
Michigan	3,652,393	W. Virginia	1,324,680
Minnesota	3,497,306	Wisconsin	3,075,234
Mississippi	2,209,509	Wyoming	1,568,607
Missouri	3,957,287		
Montana	2,580,405	Total	$121,875,000
Nebraska	2,644,726		

The amount of money that will actually be expended in each state will depend, of course, on the amount the state is willing or able to appropriate to match the federal aid.

Cloudbursts Cause Damage in Three Western States

A series of rainstorms, some of them approaching the nature of cloudbursts, swept over Utah, Wyoming and Arizona last week and caused much damage to roads, railways, dams and bridges. There was also some loss of life.

The business section of Ogden, Utah, was flooded and water pouring from the foothills caused residents in one section of the city to use sandbags to protect their property.

A landslide in Provo Canyon, Utah, dammed the Provo River, forming a large lake and threatening the city of Provo had the debris given way.

In Salt Lake Valley town and farm homes, gardens, farm lands and highways were buried by mud and rock which poured out of the canyons. At Bingham, the site of the Utah Copper Co.'s mine, torrents rushed down the city's single long street, demolishing twenty homes, damaging many more and filling business houses with mud and rock. Nearly a hundred residents of farms in the path of the storm were driven from their homes. The Salt Lake-Ogden highway was buried under piles of huge rocks and trees in three places. The Lincoln highway was blocked by several slides near Magna and Garfield.

Landslides, washouts and damaged roadbeds were reported on many important highways in Arizona. At one time the Apache trail was the only route open between Phoenix and Globe. Many towns were isolated. The loss in Arizona, however, was reported to be more than made up by the benefits to ranchers. Ranges and fields were soaked and waterholes were replenished.

The eastbound Hopi Limited train of the Santa Fe Ry. hit a weakened bridge at Joseph City, 23 miles east of Winslow, Ariz., on Aug. 8 and ran into a washout. Two trainmen were killed and 29 passengers were injured. Traffic was not restored for 24 hours.

Flood water swept down from the mountains surrounding the twin cities of Nogales, Ariz., and Nogales, Mexico, and swept away many homes. Four persons are known to have perished. American and Mexican officials are discussing plans for a drainage system to carry off such floods should they occur in the future.

TOWBOAT FOR SERVICE ON INLAND WATERWAYS

The "Ohio," the first of a new type of steam towboat constructed for packet freight service between Cincinnati and New Orleans, was launched June 17. It is said to be the largest towboat ever constructed for service on inland rivers, being 200 ft. long with a beam of 40 ft. and a depth of 10 ft. 6 in. and displacing 1,170 tons with a draft of 6½ ft. Hull and superstructure are of all-steel construction. The boat is of the twin-screw, tunnel stern type, with bow of the modified spoon type. It will be propelled by two three-cylinder vertical condensing engines with a total of 2,100 hp., driving solid four-bladed cast-steel propellers 8 ft. 9 in. in diameter turning about 185 r.p.m. Towboats of this type will handle a fleet of seventeen 300-ton barges, each 109 ft. long and 21 ft. wide. The "Ohio" was built by the Dravo Contracting Co., Pittsburgh, Pa., at a cost of approximately $500,000.

West Coast Electrical Companies Plan Many Projects

The associated electrical companies of the Nevada-California Electric Corp. have expended this year approximately $1,150,000 for construction work, according to announcement of F. O. Dolson, general manager, Southern Sierras Power Co. This figure includes about $400,000 for the completion of a high-voltage line from San Bernardino to the steam plant of the Los Angeles Gas & Electric Corp. at Seal Beach, which was not included in the $2,000,000 1930 budget. Mr. Dolson points out, therefore, that there is yet to be expended $1,250,000 on construction jobs allowed for in the 1930 budget on which work is now under way or yet to be started.

The construction completed thus far this year includes resurfacing the Hillside dam, on the south fork of Bishop Creek 20 miles from Bishop. This is a rockfill dam with timber facing and is being refaced with redwood planking. The work was commenced in April and is about 50 per cent completed. The total cost will be approximately $100,000.

Water-Power Development for Northern Ontario

Work will be started as soon as possible on one of the largest water-power developments in northern Ontario. The Dominion Construction Co. has been awarded a contract by the Ontario Power Service Corp., a subsidiary of the Abitibi Power & Paper Co., to develop the power site known as the Abitibi Canyon, about 64 miles north of Cochrane. The total drainage area of the Abitibi River at the canyon is about 8,400 square miles, and power will be developed under a net head of 237 ft. The dam will be erected on a solid rock foundation and will be of concrete. The power house will contain five generating units, of not less than 55,000 hp. each, making a total installation of 275,000 hp. The Ontario Hydro Electric Power Commission has a 40-year contract with the Ontario Power Service Corp. under which it will take at the outset 85,000 hp., to be subsequently increased to 100,000 hp.

J. H. Edwards, of American Bridge, Dies Suddenly

James H. Edwards, chief engineer of the American Bridge Co., died suddenly on Aug. 14 in New York, after only two days' illness. With his death there passes one of the notable figures in the development of structural steel engineering, a man gifted with a keen, incisive mind, remarkable clearsightedness in technical matters, and at the same time high systematizing and organizing ability. He was an engineer and a man of highest type.

James Harvey Edwards was born in Oxford, Chenango County, N. Y., June 19, 1864, and received his first practical training there in his father's foundry. At graduation from Cornell in 1888 his thesis was a critical analysis of the deficient bracing of the lenticular or Berlin parabolic truss then popular for highway bridges but soon to become obsolete. Later in that year he entered the employ of the Berlin Iron Bridge Co., East Berlin, Conn., as a structural draftsman.

Rising rapidly, he was appointed chief engineer in 1897. Prior to 1890 the steel-frame industrial building had not existed, but the company pioneered in the type and developed it to high perfection, largely through Edwards' genius in design, his penetrating technical judgment and intuitive perception of bracing. This development was Edwards' main achievement in the earlier period of his career. East Berlin became a school in which many able structural engineers received their grounding.

In 1900, when the Berlin company merged in the newly formed American Bridge Co., Mr. Edwards was appointed structural engineer, in 1901 assistant chief engineer, and in 1927 chief engineer—in this position following three famous predecessors, C. C. Schneider, Paul Wolfel and C. W. Bryan. Before becoming chief engineer he was in general charge of all building work, and in connection with this responsibility he carried out or took part in extensive test work, including the strength of beam connections and many other details, as well as columns, riveted joints and angles. His practical engineering perception led him always to support his design practice on test; though he appreciated stress analysis, he realized its limitations and power to mislead. As chief engineer he continued his attention to the technical problems of design, but also gave much effort to his new organizing responsibilities, with noteworthy success.

Mr. Edwards in 1916 was placed in charge of the building program of all components of the United States Steel Corporation, and in this capacity directed and inspired particularly the design of the new mill at Homestead, the Lorain plant of the National Tube Co., and the new mill now being built at Gary. He was also much occupied in the bridge company's standardization activities, and for years took part in the development of new I-beam sections, including the constant-dimension column and culminating in the new CB series brought out three years ago.

Soon after the war period, during which he served efficiently at Washington, he took up study of fusion welding, and though steeped in older tradition, he soon became convinced of its structural future. He made tests and laid plans to apply welding practically, developing new forms of structural design and detail suited to welding. After some introductory practical work he induced his company to establish a welding shop at its Trenton plant, and by his combined engineering and business vision brought into being many of the principal welded buildings in the country. Coincidentally he took active part in the American Welding Society, became its vice-president and head of its structural steel welding committee, and organized for this committee an elaborate series of joint tests now in progress. A year ago the society awarded him a medal for conspicuous contribution to the advancement of the welding art.

JAMES HARVEY EDWARDS

Mr. Edwards gave much effort also to other professional activities. He was prominent in the American Society of Civil Engineers, being a director (1913) and member of its column test committee and of its committee on stresses in structural steel, where he led in advocating a basic tensile stress of 20,000 lb. per square inch. He was a member of the American Iron and Steel Institute, the American Railway Engineering Association and other technical bodies, as well as of the Engineers Club and various social organizations. He served on the Merchants Association committee to frame a new building code for New York City, and on many other semipublic bodies. For fifteen years he was a trustee of Cornell University, and played a large part in creating its great armory hall.

George B. Ford, Regional Expert, Dies

George Burdett Ford, of New York City, general director of the Regional Plan Association, died on Aug. 13 from complications that followed an operation. He was 51 years old at the time of his death.

Mr. Ford gained an international reputation as a regional planning expert. He had acted as consulting engineer to more than 100 city planning commissions in 30 American cities. In 1910 he was appointed United States delegate to the International Housing Congress in Vienna. Soon after his return from Vienna he was appointed consulting engineer to the committee on city planning of the New York City board of estimate and apportionment and to the commission on building districts and restrictions of New York. Still later he became adviser of the Russell Sage Foundation Regional Plan of New York and Its Environs in its work of preparing its broad studies of the regional needs of the whole New York Metropolitan area.

After the World War, in which Mr. Ford served in the American Red Cross, competition among French architects concerning the reconstruction of the city of Rheims became so keen that the government called in Mr. Ford. For his work in the replanning of that city the French government made him a Chevalier of the Legion of Honor.

Examination for County Superintendent of Highways

Notice from the civil service board at Albany, N. Y., has been received by the Seneca County board of supervisors that an examination is to be held for the post of county superintendent of highways some time this month. The position at present is temporarily held by Edson Hudson. The maximum age limit for the position has been set at 45 years.

Highway Safety Booklet Available

The National Conference on Street and Highway Safety announces the publication of "Ways and Means to Traffic Safety," the report of its Third National Conference held in Washington, May 27-29, 1930. The report, which contains many recommendations for traffic improvement, embodies the consolidated results of the work of three National Conferences (1924, 1926 and 1930) and their committees. It deals with uniform traffic regulations, enforcement of traffic laws and regulations, education of highway users, traffic accident records, construction and maintenance of motor vehicles, and street and highway traffic facilities. Copies may be obtained on request from the National Conference on Street and Highway Safety, Washington, D. C.

Kentucky's Bridge Program Approved by War Department

The $10,000,000 toll bridge building program of the Kentucky highway commission has received the official approval of the secretary of war, who has issued permits for the construction of all bridges included in the commission's program. Bonds for the construction of the bridges, to be built over the Ohio, Tennessee, Cumberland, Green and Kentucky rivers, have already been sold to a group of Chicago, St. Louis and Toledo bond buyers. Bids will be opened in September for the construction of the spans.

The bridges planned and their estimated costs are:

Interstate—Over the Ohio River at Ashland, $1,200,000; at Carrollton, $1,474,000, and at Maysville, $1,701,000.

Intrastate—Over the Tennessee River, at Paducah, $887,000, and at Eggners Ferry, $878,000. Over the Cumberland River, at Burnside, $312,000; at Smithland, $460,000, and at Canton, $554,000. Over the Kentucky River, at Tyrone, $485,000, and at Boonesboro, $308,000. Over the Green River, at Spottsville, $313,000.

St. Lawrence Power Development Commission Named

Governor Roosevelt, of New York, last week announced his appointments to the St. Lawrence Power Development Commission, authorized by the 1930 legislature. The members of the commission will be: Frederick M. Davenport, member of Congress, professor of law and politics at Hamilton College, Clinton, N. Y.; Julius Henry Cohen, counsel to the Port Authority of New York and New Jersey; Thomas H. Conway, Plattsburg, N. Y., former lieutenant governor of New York; Samuel L. Fuller, banker and member of the firm of Kissel, Kinnicutt & Co., New York City; Robert M. Haig, professor, school of business, Columbia University, New York City.

The law provides that the governor shall appoint five commissioners to study and report plans for the development and a form of contract for the sale of hydro-electric power to be generated at water-power sites on the St. Lawrence River, owned or controlled by the people of the state. Such report shall be made to the governor and the legislature not later than Jan. 15, 1931. The commissioners are to receive no salary but are to be paid reasonable expenses and a per diem allowance of $25. The law creating the commission specifies that the governor's plan for state development must be studied first. Nothing in the statute, however, precludes making a study of private development.

Governor Roosevelt announced that he had asked Professor Haig to serve as chairman. Professor Haig was born in Columbus, Ohio, in 1887, and has been identified with Columbia University since 1912. He has had wide experience as an investigator. He was special investigator for the Treasury Department in 1917 and was once adviser to the tax board of British Columbia. He served as secretary of the joint commission on taxation and retrenchment of New York State for several years and four years ago was sent to France by Columbia University to study French finances. He was adviser to the California tax commission in 1928.

Cornell Construction Engineer of Prettyboy Dam

Charles Brown Cornell, who has been engaged in engineering work in connection with reservoirs and dams for many years, has been appointed construction engineer of the Prettyboy dam and reservoir to be constructed by the city of Baltimore. The appointment was made by the public improvement commission upon the recommendation of Charles F. Goob, chief engineer of Baltimore; Dr. John H. Gregory, of the Johns Hopkins University school of engineering, and H. Webster Smith, chairman of the public improvement commission. Mr. Cornell headed a list of eligibles prepared by the city service commission.

Mr. Cornell built the O'Shaughnessey dam and reservoir at Columbus, Ohio, and is now engaged on the Mahoning Valley Sanitary District dam and reservoir, Youngstown, Ohio. It was announced that he will take up his work in Baltimore as soon as he can be relieved of his present duties.

The Prettyboy dam and reservoir project will cost about $3,500,000. Work already has started with the construction of roads into the area. About 1,600 acres are being cleared and will be flooded. The reservoir will hold 26,000,000,000 gal. of water.

THE SYDNEY HARBOR BRIDGE IN JUNE

This view is taken during the celebration of the completion of Miss Amy Johnson's flight from London to Australia. Closure of the 1,650-ft. arch was completed on Aug. 18.

St. Paul's Cathedral, London, Opened After Repairs

Following extensive operations for the strengthening and repair of St. Paul's Cathedral, Sir Christopher Wren's notable masterpiece in London, the edifice was recently re-opened to the public by King George. The work of reparation consisted principally in consolidating the eight piers and 32 buttresses which carry the immense weight of the dome, estimated at about 26,000 tons, to shallow footings resting on sand and gravel only 4½ ft. below the level of the crypt floor. This was accomplished by forcing liquid cement under pressure through holes drilled into the piers, and by the addition of rustless steel reinforcing rods.

Another part of the undertaking was the tying together of the inner and outer drums of the dome itself by means of 48 3-in. rustless steel rods installed diagonally from the level of the base of the colonnade to points of emergence between the carved stone brackets supporting the Whispering Gallery. In addition, a 450-ft. rustless steel chain was placed around the exterior of the outer drum just above the tops of the hidden buttresses and immediately below the roof to prevent spreading.

The work, which has been in progress since 1925, was accomplished at a cost of slightly less than $2,000,000. The cathedral is now believed to be safe for many years to come, provided no extensive excavation work is done in the vicinity. The shallowness of the foundation sustaining the cathedral makes it probable that any disturbance of the subsoil would have a detrimental effect on the stability of the structure.

Pan American Highway to Get Impetus From Road Congress

Material impetus to the construction of the Pan American highway is expected to result from the deliberations of the Sixth International Road Congress in Washington Oct. 6 to 11, at which, in addition to countries from other parts of the world, virtually every Latin American country will be represented. Already many of the twenty Latin American countries that are members of the Pan American Union have announced officially that they will be represented by delegations, and acceptances are expected from the others in due time. Only one country, Nicaragua, has definitely declined.

Ever since it was known that the congress would hold its sixth session in the United States those in touch with the situation have had in mind the aim of making the congress appeal especially to countries of the Western Hemisphere. The first step in this direction was to make Spanish one of the official languages of the congress and as a result reports and other matters printed for the delegates are being prepared in Spanish, French, German and English.

Brief News

Construction has been started on the new $140,000 sanitary sewer system in the industrial section of Richmond, Calif.

Fire of undetermined origin on Aug. 10 destroyed the new $1,000,000 Canadian National Railway pier in Burrard Inlet, Vancouver, B. C.

A Contract for the construction of eighteen hangars at Randolph Field, Texas, has been awarded to Kenneth L. Colburn, Inc., of Pasadena, Calif., the lowest bidder. The amount involved is $566,820.

Plans for a Bridge to be constructed across the Maumee River at Toledo, Ohio, have been approved by the War Department. The channel spans will have 125 ft. vertical clearance above low water datum.

The Ninth of the fifteen highway toll bridges authorized to be constructed under direction of the Alabama State Bridge Corp. was opened to traffic Aug. 10. It is known as the Julia S. Tutweiler memorial bridge and crosses the Tombigbee River at Gainesville.

The Contract for the construction of a tunnel to parallel Lewis tunnel on the Chesapeake & Ohio Railway 15 miles west of Covington, Va., has been awarded to the Bates & Rogers Construction Co., of Chicago. The estimated cost will be $1,100,000. The tunnel will be 3,168 ft. long and is part of the track improvement program being caried out by the railway company.

Positions Are Open under the civil service for senior topographic draftsman, $2,000 a year; topographic draftsman, $1,800; assistant topographic draftsman, $1,620, and junior topographic draftsman, $1,440. Applications must be on file with the Civil Service Commission, Washington, D. C., by Oct. 1. There will be no examination.

The Hydro-Electric Plant of the British Aluminium Co., at Lochaber, Scotland, was recently put into operation. This plant, which will have an ultimate capacity of 120,000 hp., is one of the largest in the United Kingdom. Current will be used chiefly for the manufacture of aluminum in a large factory at Fort William. The details of the current construction were described in *Engineering News-Record*, July 4, 1929, p. 11.

Authorization of a $3,000,000 bond issue by the Memphis artesian water department for the erection of a new pumping station with a capacity of 15,000,000 gal. daily will be asked at the next session of the Tennessee legislature. The new plant will cost $2,000,000 and the bond issue will finance other necessary expenditures during 1931-33. The bond issue will add nothing to the tax burden, as the water department pays its bonds out of earnings.

Large Irrigation Projects in Mexico

Two large irrigation projects will be started soon at Matamoros, Mexico. The land to be irrigated is approximately 2,000,000 acres, situated between the Rio Grande and the Soto la Marina River. This land was taken over by the Mexican government under the agrarian act a few years ago, but has now been restored to its former owners. Two systems of canals and ditches will be built, one to take its water from the Rio Grande and the other from the San Juan River. The area to be irrigated borders the Rio Grande for more than 50 miles. Cotton will be the principal crop, it is stated.

The Business Outlook

Business activity increased last week and our indicator moved upward for the first time since the beginning of July. The upturn occurred in spite of the disposition of many business men to sit tight until effects of the drought can be more accurately appraised. These, as early exaggerations fade, will be discovered not to be calamitous. There is reason to believe the worst is over—that recovery has begun; that it will be rapid as compared with recovery in 1921. Sentiment in financial quarters continues to lag behind sentiment in commercial circles. Banking caution, not to say timidity, is retarding business.

—The Business Week, Aug. 20.

Royal Gorge Suspension Bridge Is Popular Attraction

Since the opening last December the Royal Gorge suspension bridge spanning the canyon west of Canon City, Colo., has paid more than $60,000 in tolls. July was the biggest month, paying $20,000, with June following close with a revenue of $15,000 in tolls. The bridge, described in *Engineering News-Record*, June 5, 1930, p. 922, is 1,050 ft. above the D.& R.G.W. tracks and famous hanging bridge in the bottom of the gorge, and was built at a cost of $250,000. It is located on two highways between Canon City and Salida and is proving popular with both tourist and local traffic. The toll charge is 75c. per person, with no charge for autos. The same company that built the bridge is now building an incline cable railway from the bridge to the bottom of the gorge on a slope of 45 deg. When this is completed it will be possible to leave the train at Colorado Springs, take a bus to the top of the gorge, cross the suspension bridge, go down the incline and catch the same train at the bottom of the canyon.

WASHINGTON NOTES

By Paul Wooton

Washington Correspondent

Illinois to Begin Work at Once on Waterway—Chicago Allowed Larger Diversion From Lake Michigan

After a conference with Governor Emmerson, of Illinois, last week, Secretary of War Hurley announced that an amicable solution of the situation concerning the Illinois waterway has been reached. The purpose of the conference was to reach an agreement whereby the unobligated portions of state funds raised to finance the work on the waterway can be loaned to the federal government. The section of the rivers and harbors bill authorizing the War Department to take over and complete the project did not provide an appropriation. In order that the work may not lapse until appropriations are available during the next session of Congress, the War Department has been seeking to have the state advance its funds. The money would be repaid to the state as soon as Congress can make the necessary appropriations.

Secretary Hurley feels that the governor is doing everything in his power to bring about a settlement of the situation that will be satisfactory to all concerned.

Since the first concern of the state is in connection with the bridges that have to be built, it is believed that the work will be concentrated on the canal section of the waterway.

Chicago to Get More Water From Lake Michigan

After conferring with the attorney-general, the War Department has approved the request of Governor Emmerson, of Illinois, for the diversion of an additional amount of Lake Michigan water at Chicago. In applying for the additional diversion, Illinois officials point out that the drought has seriously reduced the flow of the Illinois River. Navigation has been impeded and sanitary conditions are becoming bad, it was stated. No specific amount of diversion was fixed by the War Department, but it is unofficially stated that an extra 6,000 sec.-ft. will be allowed, bringing the total diversion to 12,500 sec.-ft. The agreement, as announced by the War Department, leaves the regulation of the diversion to Col. W. C. Weeks, district engineer at Chicago, as he may determine necessity demands.

As the flow through the drainage canal is limited by the decree of the supreme court to 6,500 sec.-ft. plus domestic pumpage, the War Department referred the matter to the attorney-general for an opinion as to the legal points concerned before approving the request for the additional diversion. This step was taken because it was felt that summary action may be adjudged to be in contempt of the supreme court. It is expected by the army engineers that the increased diversion will result in a noticeable raising of the Illinois River.

No effect will be had on the Mississippi, however, it is stated.

Despite the drought, the level of the Great Lakes is still several feet above normal. It is not expected, therefore, that the additional diversion will result in an appreciable lowering of lake levels. A condition to the War Department order permitting an additional diversion at Chicago is that the withdrawal of water be drastically curtailed after the drought has passed. In this manner the annual average flow limit fixed by the supreme court will not be increased.

Personal Notes

J. P. Soderstrom, who has been city manager at Rapid City, S. D., for six years, has been appointed city manager at Grand Junction, Colo., succeeding T. E. Thompson, who has taken a similar office in Shawnee, Okla.

Benjamin V. Howe, formerly with the state sanitary engineering department of Massachusetts, has been named sanitary engineer for the Colorado state health department, filling the vacancy caused by the death of M. J. Lonergan. Mr. Howe is a graduate of the Massachusetts Institute of Technology.

Richard G. Williams, superintendent of aid projects, Texas state highway department, since March, 1928, has recently resigned to accept the position as city manager of Bryan, Tex. Prior to his connection with the Texas department Mr. Williams served eight years as highway engineer with the U. S. Bureau of Public Roads and he also served seven years as assistant engineer with the New York state highway department previous to his governmental connection.

W. L. Thompson, in charge of dredging operations on the Beauharnois Canal, St. Lawrence River, for the Beauharnois Construction Co., has resigned to accept a return engagement in British India. His work will be largely hydraulic filling for extension of oilfield development, in connection with flood-control works built by Mr. Thompson in 1925-28 for the Indo-Burma Petroleum Co. on the Irrawaddy River.

A. R. Smith has been appointed executive engineer of the turbine engineering department of the General Electric Co., Schenectady, N. Y., to succeed the late William J. Delles. Mr. Smith will retain his responsibility as engineer of the construction engineering department. He has been with the General Electric Co. since 1897, and with the construction engineering department since 1908.

J. C. Baxter has resigned as vice-president and contract manager of A. Guthrie & Co., Inc., and has associated himself with W. F. Carey and Leonard Kennedy under the firm name of Carey, Baxter & Kennedy, with offices in New York City. The new firm will succeed Kennedy & Carey, who recently completed more than 150 km. of the Cochabamba-Santa Cruz Ry. for the Bolivian government. Mr. Baxter supervised the work of building the Great Northern Ry.'s Cascade tunnel in Washington for A. Guthrie & Co., the contractors.

K. B. Duncan has been appointed chief engineer of the Gulf, Colorado & Santa Fe Ry. to succeed the late Frank Merritt. Mr. Duncan, who was promoted from the post of district engineer, has been in the engineering department of the railroad since 1908.

The Merritt-Chapman & Scott Corporation, of New York City, announces the organization of a marine department which will conduct all salvage, diving, derrick and lighterage operations of the corporation under the direction of Walter N. Davis, vice-president; Lewis L. Smith, assistant vice-president, and Hubert M. Vanderbilt, traffic manager.

Society Calendar

AMERICAN IRON & STEEL INSTITUTE, New York City; semi-annual meeting, New York City, Oct. 24.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York; fall meeting, St. Louis, Mo., Oct. 1-3.

AMERICAN WELDING SOCIETY, New York; fall meeting, Chicago, Sept. 22-27.

NATIONAL SAFETY CONGRESS, Chicago; annual meeting, Pittsburgh, Pa., Sept. 29-Oct. 3.

AMERICAN CHEMICAL SOCIETY will hold its 80th semi-annual meeting at Cincinnati Sept. 8-12. In the division of water, sewage and sanitation chemistry, meeting on Sept. 10 and 11, many papers will be presented of interest to civil engineers.

COLORADO SECTION, Am.Soc.C.E., held a special summer dinner and meeting Aug. 12 at the Denver Athletic Club in Denver to hear W. W. De Berard, associate editor, *Engineering News-Record*, give an illustrated talk on the Mississippi River flood-control situation. Thirty-five were present.

INTERNATIONAL ASSOCIATION OF STREET SANITATION OFFICIALS will hold its eleventh conference in Louisville, Ky., Oct. 9 to 11. A program of papers and discussions of interest to sanitation officials has been prepared. The secretary is A. M. Anderson, 100 North LaSalle St., Chicago, Ill.

INTERNATIONAL CITY MANAGERS ASSOCIATION will hold its seventeenth annual meeting in San Francisco, Sept. 24-27. Papers will be presented on the subjects of municipal finance, personnel administration, police administration, and reporting to the public.

MISSOURI WATER AND SEWERAGE CONFERENCE will hold its sixth annual meeting at Columbia, Mo., Oct. 23-25. Distribution, pumping and purification of water supplies and treatment of sewage will be included in the program. The secretary is H. D. Peters, state board of health, Jefferson City, Mo.

NATIONAL PAVING BRICK MANUFACTURERS ASSOCIATION will hold its 25th annual meeting at Pittsburgh, Feb. 4-6, 1931. The program, to be presented by prominent engineers and paving authorities, will include descriptions of recently constructed brick superhighways and discussions of such subjects as the resurfacing of old pavements with vitrified brick, the salvaging of old brick in reconstruction projects, fillers for vitrified brick pavements, efficient management of brick paving contracts, and highway research applied to brick pavements.

Obituary

Walter Rehorn, city engineer of Walla Walla, Wash., for the last twenty years, was fatally injured on Aug. 7 when the automobile in which he was riding slid down a hill and plunged off a 100-ft. bluff 4 miles west of Dayton, Wash. Mr. Rehorn was 48 years old.

J. W. Brannan, president of the J. W. Brannan Sand & Gravel Co., of Denver, died on Aug. 6 following an attack of acute gastritis. Mr. Brannan was a pioneer in the sand and gravel business in Denver and had built his company into one of the largest firms of its kind in the West. He was 61 years old.

Frank Merritt, for 21 years chief engineer of the Gulf Lines of the Gulf, Colorado & Santa Fe Ry., died suddenly on Aug. 3 of heart disease at his home in Galveston, Tex. He was 75 years old. Mr. Merritt was graduated from Tufts College and had recently endowed a scholarship there.

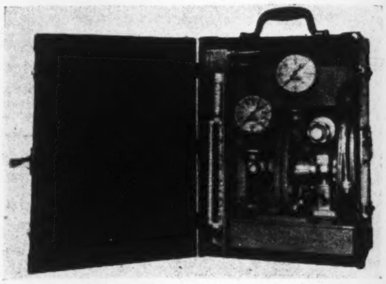
Ira Nelson Hollis, former president of Worcester Polytechnic Institute and former professor of engineering at Harvard University, died in Cambridge, Mass., on Aug. 15 in his 74th year. Dr. Hollis was graduated from the Naval Academy in 1878 and served as a naval engineer until 1893, when he resigned to become professor of engineering at Harvard, remaining in that position until 1913, when he became president of Worcester Polytechnic Institute. He retired in 1925. While at Harvard he was chairman of the committee on athletics for several years and in that capacity had charge of building the Harvard stadium. He was a past-president and an honorary member of the American Society of Mechanical Engineers.

William A. McGonagle, president of the Duluth, Missabe & Northern Ry. and a former railroad engineer, with nearly 50 years' experience on the railroads of the Minnesota iron ranges, died in Duluth, Minn., on Aug. 2. He was born at Conshohocken, Pa., in March, 1861, and after being graduated from the University of Pennsylvania in 1881 he entered the engineering department of the Northern Pacific Ry. In 1882 he became an assistant engineer on the Duluth & Iron Range R.R., and was made superintendent of bridges and buildings in 1890 and assistant chief engineer in 1901. He was appointed assistant to the president of the Duluth, Missabe & Northern Ry. in 1902, vice-president and general manager in 1903 and president in 1909, retaining also the position of general manager until 1918. In January, 1930, these two ore roads were united as a single system for operating purposes, under Mr. McGonagle's administration. He was one of the founders of the American Railway Bridge and Building Association and was its president in 1895. He was a member also of the American Railway Engineering Association.

Construction Equipment and Materials

Ammoniator in Portable Form

Application of ammonia to water supplies at rates varying from 1 to 300 lb. per 24 hours or, with special equipment, to a minimum limit of 0.05 lb. per 24 hours is possible with the portable ammoniator developed by the Paradon Manufacturing Co., Arlington, N. J. The apparatus, in detail, is similar to the Paradon chlorinator of the portable type, excepting that the parts are made of materials which will withstand the corrosive effects of ammonia. A shut-off valve is provided to keep moisture and foreign material out of the apparatus during periods of non-use. No water supply is necessary for its operation, as the ammonia gas is applied directly. For transportation, the apparatus is packed in a fiber carrying case resembling a piece of hand luggage.


COMPACT DEVICE FOR FEEDING AMMONIA

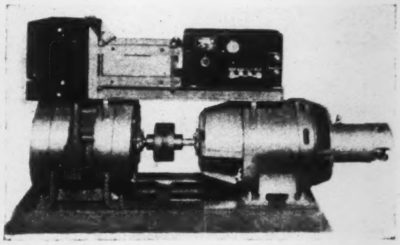
Light Weight Features $\frac{3}{8}$-Cu.Yd. Three-Quarter Swing Shovel

A convertible $\frac{3}{4}$-swing clean-up shovel with a capacity of $\frac{3}{8}$ cu.yd. and a weight of less than 10 tons has been announced by the Byers Machine Co., Ravenna, Ohio. In machinery arrangement, this machine is similar to the company's full circle models. The direct type of drive from motor to jackshaft by silent chain is used. All deck machinery is mounted on one unit steel casting. Equipment includes Timken roller bearings, worm boom hoist, power clutches, independent cable crowd, and a double steering device operating through a single $5\frac{1}{4}$-in. travel shaft in the car body. Power is supplied by a 36-hp. motor which develops a single line speed of 140 ft. per minute. Besides operating as a shovel, the machine may be rigged as a clamshell, dragline, trencher or skimmer.

$\frac{3}{8}$-CU.YD. SHOVEL LOADING GRAVEL

Welder Rated at 600 Amp.

Demand for higher welding currents to be used with large metallic and carbon electrodes has led to the development of a new welder with a rating of 600 amp. by the Lincoln Electric Co., Cleveland, Ohio. This is available either in the portable truck type or stationary truck type. It is a motor-driven, single-operator, variable-voltage machine with a current range of from 180 to 750 amp. The motor and generator are direct-connected. All controls are contained in a ventilated inclosed steel cabinet with hand regulators and switches mounted on a side panel. This control panel contains rheostat, diverter switch, safety starter switch, volt-ammeter and wing nut terminals for cables. The overhead mounting of the control cabinet permits easy access by the operator and also permits the removal of the motor generator armature without disturbing any other parts.


MOTOR GENERATOR SET FOR WELDING

Felt Seal Protects Ball Bearings

By providing a felt seal as an integral part, S K F Industries, Inc., New York City, has developed a new type of patented ball bearing in sizes applicable to a wide range of small mechanical equipment. The seal consists of an inner plate which is dished at its periphery and bears against a shoulder formed on the outer race. A removable felt of substantial size comes next, then a dished steel end plate, which is held in place by a split steel ring fitted into a groove in the outer race. To disassemble, it is merely necessary to spring the split steel ring out of the groove, after which all the other component parts may be lifted out. The inner race of the bearing projects a little beyond the face of the seal in order that it may be pulled off the shaft at any time without damaging the seal plates.

SEALED BEARING

Costs and Contracts

E. N.-R. Index Numbers

Cost			Volume		
Aug. 1,	**1930**	**200.95**	**July,**	**1930**	**226**
July 1,	1930	200.95	June,	1930	324
Aug. 1,	1929	205.91	July,	1929	320
Average,	1929	207.02	Average,	1929	317
Average,	1928	206.78	Average,	1928	287
1913	......	100.00	1913	....	100

This Week's Contracts

Heavy construction contracts, reported by *Engineering News-Record* in the week of Aug. 21, with some comparisons, total as follows:

(In Thousands of Dollars)

	Aug. 21, 1930	Average of Last Four Weeks 1930	Average of Last Four Weeks 1929
Buildings:			
Industrial	$4,118	$5,011	$7,770
Other	18,913	24,624	39,270
Streets and roads	9,281	12,860	13,257
Other eng. constr.	8,222	19,236	12,819
Total	$40,534	$61,732	$73,117

Total, all classes Jan. 1 to Aug. 21:
1930 ....$2,312,334
1929 2,838,498

New Publications

Clamshell Buckets — Joseph F. Kiesler Co., 928 W. Huron St., Chicago, Ill., has issued a 12-p. illustrated bulletin on the Kiesler Type D digging clamshell bucket.

Portable Drills—Operations possible with the Togglebug portable drill, a heavy wheel-mounted drill for use on structural steel, are outlined in a 16-p. illustrated bulletin issued by the Güibert Steel Co., P. O. Box 1037, Pittsburgh, Pa.

Automatic Primers—Tables giving sizes and capacities of standard primers for centrifugal pumps are given in a 4-p. folder issued by the Automatic Primer Co., 111 West Washington St., Chicago, Ill.

Utility Supplies—A large assortment of supplies used in the maintenance of gas distribution piping and in street repairs is described in catalog 32 of the Safety Gas Main Stopper Co., 523 Atlantic Ave., Brooklyn, N. Y.

Air Compressors — Popular types and sizes of horizontal, double-acting, inclosed frame, self-oiling air compressors are described in bulletin 59 of the American Air Compressor Works, 558 Hamilton Ave., Brooklyn, N. Y.

Centrifugal Pumps — Double-suction, single-stage centrifugal pumps with capacities up to 20,000 gal. per minute and for heads up to 300 ft. are described in a 16-p. illustrated bulletin 215 of the Pennsylvania Pump & Compressor Co., Easton, Pa.

Unit Prices From Current Construction Bids

4,385,000-Cu.Yd. Earthwork on Arkansas River

LAST YEAR'S work on the south bend enlargement of the south-bank levee of the Arkansas River totaled thirteen contracts for 6,678,000 cu.yd. earthwork. In May, 1930, eight contracts were let for 3,935,000 cu.yd. just north of the 1929 work. In addition, the government will build a section (item 33) involving 450,000 cu.yd. Of the eight awards, all except three (items 28 to 30) were to the lowest bidders. Lower bids on the three items named were submitted by Sternberg Co., but with the provision that all or none of the items be awarded it. In the tabulation, A is the award price and B is the nearest bid, in the three cases being those of Sternberg. The awards were as follows: items 25-26, J. W. Noble and T. W. Crow, Fayette, Miss.; items 28, 29, 32, Rodgers, Jones & Uzzelle, 62 South Front St., Memphis; Item 30, 31, 36, W. E. Callahan Construction Co., 1220 Arcade Bldg., St. Louis. The weighted average of the seven low bids is 23.2c. Work will be done by dragline. J. C. H. Lee is district engineer.

CONTRACT PRICE, CLOSEST BID, AND AVERAGE ON NINE LEVEE CONTRACTS ON ARKANSAS

Item	—Cents Per Cubic Yard— A	B	Average
25. Sect. 2, below Jefferson-Lincoln County line, 4. 10,000 cu.yd.	23.87	25.00	29.20
26. Round Lake to Old River, 645,000 cu.yd.	23.87	25.00	27.10
28. Kimbrough to Heckatoo, 525,000 cu.yd.	26.80	25.00*	27.50
29. Upper State Farm, 525,000 cu.yd.	25.40	25.00*	28.40
30. State Farm, 425,000 cu.yd.	20.00	24.00*	25.82
31. Lower State Farm, 400,000 cu.yd.	20.00	24.00	25.80
32. Above Auburn, 330,000 cu.yd.	24.00	26.80	28.80
33. Auburn to Douglass, 450,000 cu.yd.	†	24.00†	26.90
36. Below Douglass to South Bend, 675,000 cu.yd.	20.00	24.00	24.80

*Sternberg Co., Inc., St. Louis, specified all items or none, but in a letter following opening requested that this provision be withdrawn.

†No award; B is Sternberg low bid; 26.90c. is second; work will be performed by government.

48-51-In. Concrete Sewer in Louisville

CRITTENDEN Drive sewer in Louisville, Ky., is being constructed under Louisville Ave., Wabasso St., Crittenden Drive and Ashbottom Road. Contract 46 was awarded May 10, 1930, for 56 lin.ft. of 4 ft. 4 in. by 6 ft. 6 in. reinforced-concrete inverted egg sewer; 2,696 ft. of 51-in., and 810 ft. of 48-in. reinforced-concrete circular sewer, to cost $72,160. The accompanying illustration gives typical sections.

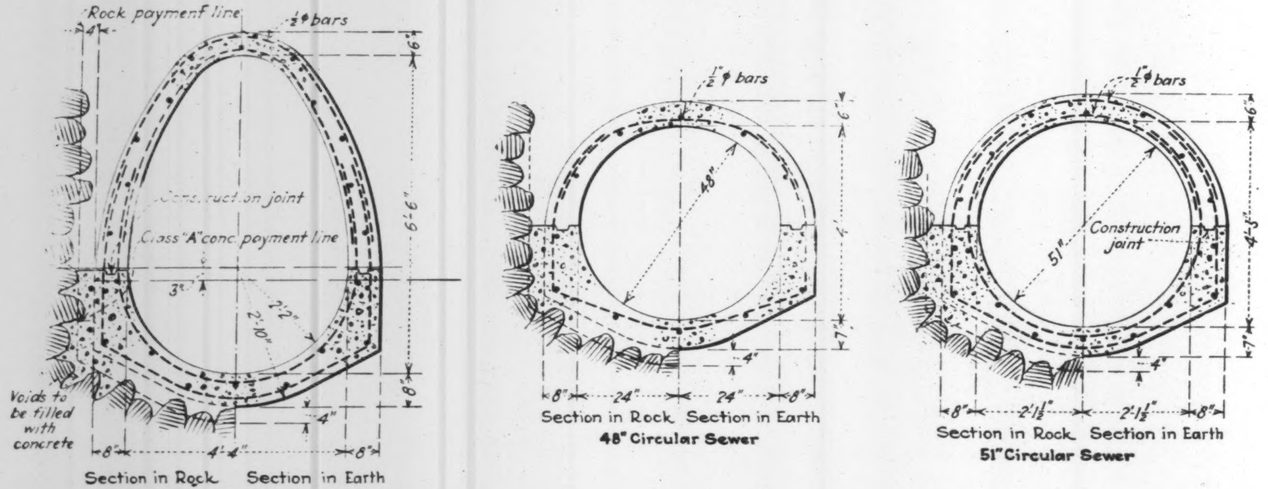
Excavation amounts to about 43 per cent of the cost. Depth varies from 12 to 19 ft., and material consists of stiff clay, plastic clay and rock. Groundwater is encountered at 7 ft. except at the egg sewer, where it is at 14½ ft., about the center line of the sewer.

Payment for rock excavation and concrete is made for a specified thickness. Voids outside this line must be filled with concrete, but not paid for. Transverse construction joints are continuous through the arch and invert and spaced not more than 30⅓ ft. Each joint is keyed and painted with one coat of refined asphalt or equivalent. Cast-iron manhole caps, covers and steps are furnished by the commissioners of sewerage, Woolsey M. Caye, technical engineer.

Bids were received from ten contractors, and unit prices are given of the lowest three: (A) Thomas D. Nolan, Detroit (contract); (B) Henry Bickel Co., Inc., Louisville; (C) Northern States Construction Co., St. Paul. To encourage early completion a bonus of $25 per day was allowed. Estimates vary from 120 to 200 days, averaging 150, the shortest time being that of Nolan.

	A	B	C
Earth excav. and backfill			
74.75 lin.ft.	$897.00*	$15.70	$6.00
2702.08 lin.ft.	16,212.00*	7.65	4.78
810.43 lin.ft.	4,052.15*	5.50	4.50
1,800 cu.yd. rock excav. and backfill (shale)	4.00	4.65	8.00
260 cu.yd. rock excav. and backfill (limestone)	10.00	10.50	11.00
Class A conc. masonry			
25 cu.yd.	19.50	22.75	20.00
1,120 cu.yd.	18.00	14.50	18.00
325 cu.yd.	18.00	15.60	18.00
85 cu.yd.	24.00	30.00	23.00
30 cu.yd. class C conc. masonry	12.00	12.00	13.50
1 cu.yd. brick masonry	40.00	25.00	35.00
8 sq.yd. vit. brick lining of inverts	5.00	5.00	5.00
110,000 lb. reinforcing bars	.06	.041	.05
100 cu.yd. earth excav. below sewer	2.00	2.00	2.00
100 cu.yd. gravel refill below sewer	3.00	3.00	3.00
Laying with cement mortar			
150 lin.ft. 6 in.	.50	.50	.50
10 lin.ft. 8 in.	.50	.50	.50
10 lin.ft. 10 in.	.50	.50	.50
10 lin.ft. 12 in.	.75	.50	.75
10 lin.ft. 15 in.	.75	.50	.85
10 lin.ft. 18 in.	1.00	.50	1.00
10 lin.ft. 21 in.	1.25	.50	1.25
10 lin.ft. 24 in.	1.50	.50	1.50
1,000 lin.ft. laying 4 in. underdrain	.20	.46	.50
1,000 lin.ft. laying 6 in. underdrain	.25	.63	.55
5,000 ft. b.m. sheeting, bracing, etc.	25.00	25.00	25.00
2,873 sq.yd. waterbound macadam	1.35	1.19	1.25
Net total	$72,159	$72,539	$74,651
Progress and completion $25 per day	†3,000	‡3,500	‡3,500
Gross total	$75,159	$76,039	$78,151

*Lump sum. †120 days. ‡140 days.



Section in Rock Section in Earth
4'-4" x 6'-6" Inverted Egg Sewer

Section in Rock Section in Earth
48" Circular Sewer

Section in Rock Section in Earth
51" Circular Sewer

TYPICAL SECTIONS, CRITTENDEN DRIVE SEWER, LOUISVILLE, KY.

CONSTRUCTION NEWS

Some of the Week's Large Projects

For further details turn to the appropriate sections in this issue.

Location	*Project*	*Cost*	*Status*
Bridge			
San Francisco	Bridge	$75,000,000	Proposed
Sports and Parks			
San Francisco	Grandstand	1,250,000	Contract
Railways			
Texas	Railroad	5,500,000	Proposed
Nevada	Railroad	2,500,000	Bids asked
Factories and Mills			
Munice, Ind	Gas plant	1,000,000	Owner builds
Fitchburg, Mass	Factory	1,000,000	Proposed
Los Angeles	Factory	2,000,000	Proposed
Buildings			
Battle Creek, Mich	Bank	1,200,000	Contract
Chicago	Club	1,500,000	Proposed
New York	Club	8,000,000	Proposed
Cambridge	University	4,000,000	Bids asked
Chicago	High school	2,288,245	Contract
Oakland, Calif	Theatre	1,000,000	Proposed
St. Louis, Mo	Railroad terminal, etc	5,000,000	Proposed

WATERWORKS

PROPOSED WORK

Ark., Clarksville — Water supply from Big Piney Creek, incl. intake tower, sedimentation basin and filters, reservoir, force mains, flow lines and mains, 50,000 ft. high lines, etc. Est. $186,450. W. L. Winters, 311 Merchants Natl. Bank Bldg., Fort Smith, engr. Noted Sept. 5.

Mo., St. Louis—See "Buildings—Unclassified."

BIDS ASKED

Ill., Chicago—Aug. 26, by Bd. P. Wks., City Hall, quantity finished hydrants parts, Pipe Yard B, 3150 South Sacramento Ave.; two 36 in. cone valves, appurtenances, 68th Street Pumping Station. R. W. Wolfe, comr.

Md., Baltimore—Aug. 27, by Bd. Awards, mains in Frederick and North Aves. E. G. Rost, Municipal Bldg., water engr.

Mass., Boston—Aug. 28, by Metropolitan Dist. Comm., Boston, 12,230 lin. ft. 20 in., 1,200 lin. ft. 16 in. c.i. pipe for waterworks, in Revere. W. E. Foss, dir. Water Div.

Mich., Detroit — Sept. 16, by Bd. Water Comrs., 735 Randolph St., 4,700 ft. more or less 36 in. water pipe in Freud Ave.; adv. E. N.-R. Aug. 21. Noted Aug. 7.

N. Y., Brooklyn—Aug. 26, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., New York, hauling, laying mains, appurtenances in Empire Blvd., Avenue H, Central Flatlands, Euclid, Meserole and Sutter Aves.; Berriman, 15th, East 37th, East 46th, East 48th and East 56th Sts.

N. Y., Canastota—Aug. 26, by Bd. Water Comrs., J. M. Heintz, Jr., clk., general contract, standpipe, softener for waterworks addition. M. Vrooman, Gloversville, engr.; adv. E. N.-R. Aug. 21.

N. Y., New York—Aug. 26, by J. J. Dietz, comr. Water Supply, Gas & Electricity, Municipal Bldg., steel and c.i. mains, appurtenances in Riverside West, Viaduct, and removing and resetting manhole heads and covers in various streets, Manhattan; furnishing, delivering, hauling, laying and lowering mains, appurtenances in Appleton, Barker, Bronxwood, Byron, Cruger, Hering, Hill, Hollywood, Jerome, Livingston, Matthews, Mayflower, Rhinelander, Rombouts, Seton, Tenbroeck, Tibbett, Tremont, Waring, Watson and Westchester Aves. Baldwin, East 174th, East 235th Sts., Williamsbridge Rd., Reiss Pl., Eastern Blvd., Grand Concourse and Reservoir Oval, W., Bronx Boro.

N. Y., New York—Aug. 28, by P. J. Dooling, comr. Purchase, Municipal Bldg., corporation cocks, hydrants to Dpt. Water Supply, Gas & Electricity, until Dec. 31, 1930.

O., Cleveland-Heights—Aug. 25, by City, c.i. mains, Monticello Blvd., Castleton, Hazelton, Rushleigh and Pembrook Roads. To exceed $25,000. F. R. Pease Engineering Co., Terminal Tower, Cleveland, engrs.

Pa., Saxonburg—Aug. 28, by R. Bowman, boro secy., 8,000 ft. 4- and 6-in. mains. Aiken & Greenough, 18 Reiber Bldg., Butler, engrs.

S. D., Dell Rapids—Aug. 25, by City Council, 65,000 gal. wood or steel water tank on existing stone tower. Dakota Eng. Co., Mitchell, engrs.

CONTRACTS AWARDED

Calif., Lynwood—See "Streets and Roads."

Ill., Princeton—Water Treatment Plant, Div. A, to H. Apperman & Son, Aurora, $17,929. Noted July 24.

Mass., Braintree—Mains, to Federico & Susi, 43 Westwood St., Dorchester; standpipe, to Pittsburgh-Des Moines Co., Neville Island, Pittsburgh, Pa.; main pipe, to R. G. Wood Co., Phila., Pa. Total est. $60,000. Noted June 12.

Tex., Kerrville—City, R. B. Ellis, mgr., 35,000 ft. 6- to 10-in. mains, 34 fire hydrants, to Wilson & Seward, Kerrville, $58,000.

SEWERS

PROPOSED WORK

Kan., Columbus—Rebuilding sewage disposal plants. $50,000. Calvin Cooper, Columbus and E. T. Archer & Co., 609 New England Bldg., Kansas City, consult. engr. Noted Aug. 7.

BIDS ASKED

Ill., Chicago—Aug. 26, by Bd. Local Impvts., City Hall, tile sewers, brick manholes, catch basins in West 55th, 97th and 98th Sts., Princeton, Lafayette, Wentworth, Harvard, Talcott, South Lorel, South Long, South Lotus, South Linder, South Luna Aves., drains in East 103rd, West 97th and South La Salle Sts., Barry, Oglesby, Gunnison, LeMay, South Oakley, South Kolin, South Kostner South Kenneth, South Kolmar, Howard, Princeton, Yale, Perry, Westworth and Lafayette Sts. M. J. Faherty, pres.

Mich., Mason—Aug. 25, by J. E. Welsh, city clk., city disposal plant addition with necessary connections. $25,000. W. E. Zimmer, city engr.

N. Y., Long Island City—Aug. 26, by G. U. Harvey, pres. Queens Boro., sanitary sewers, appurtenances in Hollis Court Blvd., 109th Pl., 119th, 145th and 110th Rds., 52nd, 94th, 33rd, 46th, 47th, 150th, 90th, 89th, 102nd, Baldwin, Continental, Courtenay, Edmore, Davenport, Jordan, Mangin, Hillside, and Hempstead Aves.; Utopia Parkway, 23rd, 56th, 39th, 127th, 148th, 95th, 48th, 191st, 189th, 158th, 184th, 190th, 191st, 205th, 222nd, 224th, Olcott, Kessell, Selfridge, Loubet, Manse, Nansen, Jamaica and Gettysburg Sts.

N. Y., Mamaroneck—Aug. 29, by Westchester Co. Sanitary Sewer Comn., E. S. Martin, secy., 1,100 ft. 54 in. c.i. sewer pipe, Class A, Sect. M; adv. E. N.-R. Aug. 21.

N. Y., St. George—Aug. 27, by J. A. Lynch, pres. Richmond Boro, sanitary sewer Waldron Ave. and other streets.

O., Cleveland — Aug. 20, by Bd. Comrs. Cuyahoga Co., 3,260 ft. 12- to 24-in. concrete, tile sewers, Cedar Glen Rd. $70,502. F. Williams, Court House, engr.

O., Cleveland Heights — Aug. 25, by City, storm and sanitary sewers in Monticello Blvd., Castleton and Hazelton Rds. To exceed $25,000. F. A. Pease Engineering Co., Terminal Tower, Cleveland, engrs.

Pa., Phila. — Aug. 26, by Dpt. P. Wks., Bureau Hys., A. Murdock, dir., City Hall Annex, Schedule A—branch sewers; Schedule B—boiler smoke and stack Mingo Creek Pumping Station.

Tex., Port Arthur—Aug. 26, by City Comn. and W. O. Bower, city engr., drainage pump station at Del Mar and Lakeview Sts. $300,000.

CONTRACTS AWARDED

Ill., Rockford—Bd. Trustees Sanitary Dist. of Rockford, sewage treatment plant Div. O to J. T. Walbridge Eng. Co., 1014 South Michigan Blvd., $384,994; Div. Q, electrical equipment to Swan Bros. Co., 627 7th St., $12,411. This corrects report in July 30 issue.

BRIDGES

PROPOSED WORK

Calif., San Francisco—California Toll Bridge Authority, preliminary plans toll bridge over San Francisco Bay from Rincon Hill, to Yerba Buena Island thence to Key System Pier site, Alameda Co. $75,000,000. C. H. Purcell, State Office Bldg., Sacramento, engr.

Texas, Oklahoma, etc.—Owners, c/o Matthews & Kenan, engrs., 1616 Smith-Young Tower, San Antonio, Tex., 2 bridges in Texas; 2 in Oklahome; 5 in Kansas; 3 in Nebraska; 1 in Iowa and 2 in Missouri, all steel, rein.-con. Total est. $750,000.

BIDS ASKED

Ga., Columbus—Aug. 27, by C. L. Rhodes, Columbus, engr., concrete viaduct, underpass and concrete box culvert over Central of Georgia & Seaboard Rys., for Muscogee Co., c/o R. H. Barnes.

Ill., Chicago—Aug. 25, by Dpt. Hys. Cook Co., County Bldg., concrete bridge over Salt Creek near 40th St. at 1st Ave.—3 concrete bridges over Des Plaines River, one at Chicago Ave., one at 1st Ave. south of Fullerton Ave., other at Oakton St. $100,000 each—also 1 culvert at 103rd St. and Roberts Rd. and 2 culverts at Ridgeland Ave. near 135th St. $10,000. G. A. Quinlan, supt.

Kentucky—Sept. 18, by State Hy. Dpt., Frankfort, bridges over Tennessee River, near Tyrone—Cumberland River at Canton—Tennessee River at Eggners Ferry—Ohio River at Carrollton. B. Johnson, hy. engr.; adv. E. N.-R. Aug. 21.

New Jersey—Sept. 3, by State Hy. Dept., Trenton, constructing Route 4, Sect. 7, Passaic River Bridge and approaches Paterson to East Paterson, Passaic and Bergen Counties. A. L. Grover, ch. engr. Adv. E. N.-R. Aug. 21.

New York—Aug. 28, by C. Macdonald, engr. Westchester Co., White Plains, Mill St. Bridge over Byram River, Port Chester—Quaker Bridge over Croton River, Cortlandt—bridge over New York Central R.R., at Harmon, Cortlandt; adv. E. N.-R. Aug. 21.

Ohio—See "Streets and Roads."

Ohio — Aug. 26, by R. N. Waid, dir. hys., Columbus, concrete, steel bridges on hys. in Butler, Fayette, Franklin, Lawrence, Brown, Marion and Ottawa Co. $331,516.

Okla., Morrison—Aug. 25, by C. S. Thompason, clk. Noble Co., at Perry, 6 span 88 ft. rein.-con. bridge. $25,000. R. S. James, Perry, engr.

Ont., Brampton—Aug. 23, by N. L. Powell, engr. Halton Co., 40 ft. span concrete, steel bridge at Caldon, two 60 ft. span bridge at Huttonville and 30 ft. span bridge here.

CONTRACTS AWARDED

New York—A. W. Brandt, comr. Hys., Albany, **(e. e. means engineers estimate)**, 80 ft. plate girder bridge, Albany and Greene Counties, to Riteway Constr. Corp., Dunkirk, $46,729 e. e. $68,246—175 ft. truss span bridge Greene Co., to R. Colegrove, Rexville, $49,838 e. e. $62,030—55 ft. plate girder bridge Hamilton Co., to Bricon Constr. Co., Inc., Indian Lake, $42,459 e. e. $56,486—24 ft. slab and 60 ft. girder bridge, Rensselaer Co., to M. R. Ingraham, Inc., Albany, $34,913 e. e. $47,170—two 120 ft. twin truss bridge, Delaware Co., to Frank Lewis & Sons, Inc., Brainbridge, $80,005 e. e. $113,258. Grand total $253,944. Noted Aug. 14.

Ohio—R. N. Waid, dir. hys., Columbus, steel beam bridge, Warren Co., to C. E. Paxson, West Alexandria, $37,008 — concrete beam bridge, Gallia Co., to Stuart-Baxter Co., 4093 Detroit Ave., Toledo, $99,796 — concrete high-level bridge, Cuyahoga and Summit Counties, to Highway Constr. Co., Builders Exch. Bldg., Cleveland, $426,294. Grand total $563,098.

Constr. News page 75

See proposal advertising on page 109

LEADITE

Trade Mark Registered U.S. Pat. Office

The Responsibilities of a Reputation

Laying 9 Miles of 20-in. c.i. bell and spigot Water Mains with Leadite Joints

A Favorable Reputation for an Industrial Product or Service, is gained only after painstaking years of maintaining Quality and giving User Satisfaction—this applies particularly to installations of a permanent character, such as a water main.

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It is SIGNIFICANT, that today, Thousands of miles of Bell and Spigot Water Mains are jointed with LEADITE—all over this great Country, and in many Overseas Countries.

The pioneer self-caulking material for c. i. pipe.
Tested and used for over 30 years.
Saves at least 75%

THE LEADITE COMPANY
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100 LBS.
LEADITE
REG. U.S. PAT. OFF.
CEMENT
For JOINTING WATER MAINS
MANUFACTURED BY
THE LEADITE COMPANY
PHILADELPHIA, PA.

No Caulking

Bridges (Continued)

South Carolina—State Hy. Dpt., Columbia, to Palmer Constr. Co., Florence, widening 3 rein.-con. bridges, Calhoun Co., $6,398; constructing rein.-con. bridge McCormick Co., $7,292; 6 rein.-con., structural steel and timber bridges, Lancaster Co., $28,687—to Clement Constr. Co., Charleston, 3 bridges, Colleton Co., $25,111—to Roanoke Iron & Bridge Works, Roanoke, Va., steel superstructure for bridges, on Routes 19 and 392, Saluda and Newberry Counties, $16,856 each—to C. Y. Thomason and G. A. Thompson & Co., Greenwood, substructure for rein.-con. bridge on Route 19, Saluda and Newberry Counties, $90,833—to G. A. Thompson & Co., Greenwood, bridge, Route 392, $102,420—to P. Gilmore, Spartanburg, 2 rein.-con. bridges, Chesterfield Co., $12,295—to R. H. H. Blackwell, Kingsport, Tenn., 2 bridges, Bamberg and Orangeburg Counties, $104,524 — to C. Y. Thomason, Greenwood, overhead bridge, Greenwood Co., $13,175 — to C. T. Felix, Carolina Life Bldg., Columbia, 4 bridges, Williamsburg Co., $32,251. Grand total $456,698. Rejected bids July 29 rein.-con. bridge, Greenwood and Laurens Counties. Noted July 17 under "Streets and Roads."

Ontario and Quebec—N. Desjardins, secy. Dpt. P. Wks., Ottawa, Ont., substructure for Interprovincial Bridge, over Ottawa River, between Hawkesbury, Ont., and Grenville, Que., to Farley & Grant, Rideau St., Ottawa, Ont., $163,189. Noted Aug. 14.

STREETS AND ROADS

BIDS ASKED

Calif., Los Angeles—Aug. 27, by Bd. P. Wks., grading, 6 in. concrete paving 215,000 sq.ft. Yorkshire Dr. and Parrish Ave. Impvt. Dist.

La., Ville Platte—August. 26, by Town Council grading, guttering, concrete paving 5,600 sq.yd. M. J. Goudean, Jr., Opelousas, engr.

Maryland—Aug. 26, by State Roads Comn., Baltimore, gravel surfacing 1.36 mi. Contr. AA-93-72, and 2 mi. Contr. AA-98-84 Anne Arundel Co.—concrete shoulders 1.6 mi. Contr. B-162-411, Baltimore Co.—concrete paving 1.3 mi. Contr. F-154-62, Frederick Co.—alternate on hot or cold bituminous mix resurfacing 2.1 mi. Contr. P-133-311, Prince Georges Co. G. C. Uhl, chn.; adv. E. N.-R. Aug. 21.

Mass., Medford (br. Boston)—Aug. 25, at Mayor's Office, 10 High St., sheet asphalt surfacing.

Michigan—Aug. 25, by R. A. Beers, resident engr., Kalamazoo, grading, concrete paving 2.514 mi. MO3-21, C-1 and MO3-22, C-1, Allegan Co., for State Hy. Dpt., Lansing.

Michigan—Aug. 26, by R. A. Beers, resident engineer, Kalamazoo, grading, concrete paving 18.502 mi. Rds. FO11-9-C-1, MO11-9C-2, FO80-4C-1, FA-148, Sect. A and B, 20 ft. Van Buren and Berrien Counties, for State Hy. Comn., Lansing.

Michigan—Aug. 27, by C. L. Cowgill, resident engineer, Plymouth, grading, shaping, concrete paving 2.468 mi. Rd. 058-19C-1, 20 ft., Monroe Co., for State Hy. Comn., Lansing.

Michigan — Aug. 27, by E. H. Haahr, resident engineer, Newberry, grading crossing of Duluth, South Shore & Atlantic R.R., Rd. 017-5-Contr. 3, Chippewa Co., for State Hy. Comn., Lansing.

Michigan—Aug. 27, by E. H. Haahr, resident engineer, Newberry, grading, shaping, waterbound macadam or gravel surfacing 8.172 mi. Rd. MO75-22C-1, 18 ft., Schoolcraft Co., for State Hy. Comn., Lansing.

Nebraska—Aug. 29, by State Dpt. P. Wks., Lincoln, concrete paving 2.5 mi., graveling 168.8 mi. grading 48.5 mi., also bridges, culverts on roads throughout state. R. L. Cochrane, State House, Lincoln, engr.

N. J., Hackensack—Aug. 26, by Bergen Co., grading, rein.-con. paving 117,039 sq.yd. Hy. Route 4, Sect. 4, Arcola to Hackensack River. J. M. Harkness, clk.; adv. E. N.-R. Aug. 21.

N. J., Hammonton—Aug. 22, by Town Council, Town Hall, 4,400 lin.ft. storm water sewer in Pratt, Tilton and Pleasant Street Sewer; 3,388 lin.ft. storm water sewer, in Egg Harbor Rd. and Cherry St. sewer. J. A. Baker, town engr.; adv. E. N.-R. Aug. 14.

N. J., New Brunswick — See "Contracts Awarded."

N. J., Westfield—Aug. 25, by Council, concrete curbing, storm sewers, rein.-con. paving 7,156 sq.yd. North Ave.; adv. E. N.-R. Aug. 21. J. T. Hopkins, town engr.

New York—Sept. 3, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, grading, concrete paving 2.08 mi. Bronx Parkway extension, from Saw Mill River Rd. to Kitchawan Rd., New Castle and Yorktown. J. Downer, Bronxville, ch. engr. adv. E. N.-R. Aug. 21.

N. Y., New York—Aug. 26, by H. Bruckner, pres. Bronx Boro, Crotona Park, sheet asphalt on concrete paving Bronx Park East—bituminous concrete on concrete paving 233rd St.—curbing, sidewalks, granite block on concrete paving 169th St.—regulating, grading, setting curb, culvert approaches, Hicks St., Wallace Ave., Osborne Pl., Middletown Rd.—constructing sewers, appurtenances in Edison, East Tremont, Baisley, Throgmorton, Kearney, Fairfax, Vincent, Corlear Aves., West 236th St.

Ohio — Aug. 26, by R. N. Waid, dir. hys., Columbus, grading, concrete, sheet asphalt, waterbound macadam, rein.-con., brick on concrete, traffic bound macadam, brick paving 21,267 mi. hys. in Allen, Belmont, Fayette, Jefferson, Lawrence, Lucas, Brown, Marion, Noble, Sandusky, Mahoning and Ottawa Counties. $1,147,227.

Okla., Perry — Aug. 25, by C. S. Thompson, clk. Noble Co., concrete slab surfacing 12,000 sq.yd. Morrison Rd. $25,000. R. S. James, Perry, hy. engr.

Pa., Phila.—Aug. 26, by Dpt. P. Wks., Bureau Hys., A. Murdock, dir., City Hall Annex, asphalt paving (assessment work)—county road improving—redressed granite block repaving—repairing concrete railway.

Tenn., Nashville—Aug. 26, by S. H. McKay, city clk., widening, concrete paving 1,600 sq.yd. 7th Ave. $120,708—improving, asphaltic concrete paving 4,000 sq.yd. Dallas Ave. $24,500—1,650 sq.yd. Petway St. (Hills Alley) $18,650—widening, asphaltic concrete paving Gay St., $73,975. W. Southgate, city engr.

Tex., Mt. Pleasant—Aug. 26, by City, c/o H. O'Tyson, mayor, permanent paving 50 blocks. D. G. Nolte, Mount Pleasant, engr.

Virginia—Aug. 26, by State Hy. Comn., Richmond, grading, macadam surfacing 1 mi. Staunton Rd., Route 39, Project F-641-D, Augusta Co.

Washington—Sept. 2, by J. S. Humes, dir. State Hy., Olympia, surfacing 4.1 mi. State Rd. 9, Nelson Creek, to Wind River, Skamania Co.—and 5 mi. bituminous paving State Rd. 11, Cheney, Spokane Co. and Junction City, Grays Harbor Co.

CONTRACTS AWARDED

California — State Hy. Comn., Sacramento, concrete paving 1.68 mi. Placer Co., to N. M. Ball, Porterville, $62,253—untreated crushed gravel or stone surfacing 1.98 mi. also bridges in Mendocino Co., to E. C. Coats, Sacramento, $85,289—oil treated crushed gravel or stone paving 16.19 mi. Riverside Co., to B. Noble, San Diego, $256,610—9.5 mi. San Bernardino Co., to H. W. Rohl, 727 West 7th St., Los Angeles, $187,326. Grand total $591,478.

Calif., Lynwood—Rock and oil surfacing, ornamental lighting system, water mains on Lewis Rd. and Standard Ave., to Kovacevich & Price, Inc., 4379 Tweedy Blvd., South Gate, $29,965.

Georgia—State Hy. Bd., East Point, concrete paving 10 mi. hy. Walton Co., to Whitley Constr. Co., La Grange, $227,267—0.7 mi. Grady Co., to C. R. Hooper, Griffin, $16,912—limerock and surface treating 12 mi. Wayne Co., to F. W. Long, Jacksonville, $225,782—10 mi. Clinch Co., to Duval Engineering & Constr. Co., Jacksonville, Fla., $207,854 — sand clay surfacing 7 mi. Berrien and Atkinson Counties, to R. P. Cook, Fairmount, $82,215—grading 2 mi. Long Co., to N. J. Morgan, Talladega, Ala., $24,570—macadam paving 5 mi. Whitfield and Murray Counties, to A. H. Singer, La Fayette, Ala., $78,952—4 bridges on hys. Berrien and Atkinson Counties, to Mallory & Nash, Hart Bldg., Atlanta, $83,416—1 overhead bridge, Houston Co., to W. J. Tidwell, Jr., Douglasville, $15,301—concrete and steel bridge Putnam Co., to D. B. Scott, Decatur, $6,246. Grand total $968,515.

Ill., Chicago — Bd. Local Impvts., curbing, guttering, paving North Ashland Ave., to Chicago Constr. Co., 5514 South Bishop St.—sidewalks North Ashland and North Western Aves., to Seiwert Callsen Co., South Ashland Ave.—South Ashland Ave., to White Paving Co., 1735 Fullerton St.—South Ashland and South Western Ave., to J. J. Croake Co., 2927 Fullerton Ave.—North Ashland Ave., to J. C. Jensen & Co., 163 West Washington St.—North and South Ashland Aves., to A. Graff & Co., 30 North LaSalle St.—North Western Ave., to Superior Concrete Constr. Co., 1109 East 52nd St.—North Western and South Western Aves., to Simpson Constr. Co., 120 South LaSalle St.—North Western and South Ashland Aves., to Banner Constr. Co., 384 North Harding Ave.—North Western Ave., to Aldrich Constr. Co., 111 West Washington St. Noted July 24.

Ia., Iowa City—G. J. Dohrer, city clk., grading, curbing, vitr. brick, sheet asphalt or rein.-con. paving 4 streets and 3 alleys, to William Harrabin Constr. Co., Iowa City, $41,995; water and gas connections, to Connell & Co., Iowa City, $4,098.

Kentucky—State Hy. Dpt., Frankfort, traffic bound limestone surfacing 12.657 mi. Henry Co., to J. M. Perkins Co., Frankfort, $77,819—rein.-con. paving 14.146 mi. Hopkins Co., to W. F. Robinson & Son, Owensboro, $263,996 — surfacing 11.107 mi. Morgan Co. and retreated on limestone surfacing 12.281 mi. Rowan Co., to R. M. Robinson, Owensboro, $48,706 and $164,902 respectively—amiesite surfacing 0.646 mi. Webster Co., to Carey-Reed Co., Lexington, $11,304—rein.-con. pipe 3.402 mi. Mercer Co., to Myers Bros., Campbellsburg, Ind., $53,886 — 6.264 mi. Madison Co., to O. V. Arnett, Berea, $51,347—5.84 mi. Nicholas Co., to Ashland Supply Co., Ashland, $45,615—corrugated metal pipe 9.972 mi. Harrison Co., to J. C. Macht, Newport, $87,607 — substructure, approaches bridge Elliott Co., to Jas. Hughes Constr. Co., Ravenna, $16,535—Floyd Co., to Carter, Carter & Braden, Clay, $67,672—steel superstructures bridges Elliott and Floyd Counties, to Vincennes Bridge Co., Vincennes, Ind., $16,251 and $25,578 respectively. Grand total $931,218. Noted July 10.

Kentucky — State Hy. Dpt., Frankfort, **(S.P. means State Project)**, to Carey-Reed Co., Lexington, retread and surface treating S.P. 5-1, Fayette Co., S.Ps. 29-A and 50-A, Madison Co., $24,944; S.Ps. 96-D, Lincoln Co., 97-C, 168-A, 16-A, Boyle Co., $9,457; S.Ps. 5-L, Rockcastle 5-K and 207-A, Madison Co. $44,549—to R. B. Tyler Co., 1446 Levering St., Louisville, S.P. 58½-B, Harrison Co.; S.P. 58½, 5-F and 5-G, Scott Co., $29,149; S.Ps. 57-F, 57-E, 58½-D Bracken Co. and S.P. 21½-B-1, Pendleton Co. $31,478; S.P. 22-G, Lincoln Co., $17,740—to Southern Oil & Tar Co., Clay St. and River Rd., Louisville, S.Ps. 59-B, 64-B, 19-D and 49-C, Owen Co., $54,913—to F. G. Breslin, 32nd and Market Sts., Louisville, S.P. 5-0, Laurel Co. and S.P. 35-A, Whitely Co., $40,084. Grand total $252,314. Rejected bids July 30, retread and surface treating S.P. 12-G and 11-L, Hardin Co. and 11-J, 11-J-1 and 11-K, Hart Co. Noted July 17.

Ky., Louisville—Asphalt paving, 2 alleys, to Woodruff & Co., 1050 Barret St., $2,933—2 alleys, to H. C. Showalter, 1443 South 3rd St., $2,321—1 alley and 1 street, to Andrews-Collings Asphalt Co., Louisville, $1,017 and $20,570 respectively—2 alleys, to C. W. McFarland, 1220 River Rd., $2,514—2 alleys, to E. Brewer, 1233 West Jefferson St., $2,663—2 alleys and 5 streets, to George M. Eady Co., Burk, Gilbert and Lee Sts., $2,700 and $44,662 respectively—2 alleys, to J. U. Schickli & Bros., 1837 Greenwood St., $2,783 — 1 alley and 7 streets, to Henry Dickel Co., Inc., 435 Garden St., $2,818 and $42,864 respectively—1 alley and 1 street, to F. G. Breslin, 32nd and Market Sts., $2,604 and $31,809 respectively—2 alleys, to K. A. Barker, Floyd and Lee Sts., $2,383—2 streets, to Louisville Asphalt Co., 240 East Lee St.

Maryland—State Roads Comn., Baltimore, concrete paving 1.8 mi. Dorchester Co., to P. D. Phillips & Bro., Salisbury, $38,297—9.97 mi. Baltimore Co. and 1.5 mi. Howard Co., to Harry T. Campbell & Sons Co., Towson, $17,124 and $98,828 respectively — concrete shoulders on 0.58 mi. Montgomery Co., to J. P. Maher, 3108 K St., N. W., Washington, D. C., $4,169—macadam on slag paving 2.8 mi. Wicomico Co., to W. W. Truitt, Lincoln City, Del., $49,738. Grand total $208,156. Noted July 31.

Massachusetts—Dpt. P. Wks., Boston, bituminous macadam paving 5,963 ft. Watertown and Waltham, to T. J. McCue, 264 North Beacon St., Watertown, $40,554—6,450 ft. Foxboro, to Perini & Ampollini, 2242 Waverly St., Framingham, $37,000—11,900 ft. Montague, to Kelleher Corp., Turners Falls, $38,599—gravel and bituminous macadam paving 7,050 ft. West Boylston, to Frank & Frank Constr. Co., 9 Doyle Ave., Providence, R. I., $23,096—4,500 ft. West Newbury, to P. J. Holland, 24 Ames St., Lawrence, $9,259 — bitulithic concrete paving 2,988 ft. Provincetown, to M. F. Roach & Sons, Inc., 55 Spring St., East Bridgewater, $20,540. Grand total $169,048. Noted July 31.

N. J., New Brunswick—Middlesex Co., County Record Bldg., will pave with bituminous macadam Woodbridge-New Brunswick Turnpike, own forces, $45,000. W. F. Buchanan, 175 Smith St., Perth Amboy, co. engr.

New York—A. W. Brandt, comr. Hys. ***(e.e. means engineers estimate)***, Albany surfacing 4.52 mi. hy. Cayuga Co. to Bero Engineering & Constr. Corp., North Tonawanda, $169,125, e. e. $430,800—1.56 mi. Monroe Co., to J. Paddelford, Sherburne, $460,946, e. e. $605,011—6.51 mi. Saratoga Co., to John P. Dugan & Co., Inc., Amsterdam, $215,009, e. e. $314,858—4.18 mi. Cayuga Co., to Neilans & Walsh, Dunkirk, $126,793, e. e. $215,142—6.82 mi. Jefferson Co., to F. Callahan, Auburn, $294,467, e. e. $430,800—1.56 mi. Monroe Co., to J. Friedrich, Rochester, $153,755, e. e. $211,051—5.3 mi. Cayuga Co., from Bolton, Suits, Bolton & Gibbs, Watkins Glen, $154,377 e. e. $216,348. Grand total $1,574,473. Rejected bids July 22 concrete paving 0.2 mi. hy. Cayuga Co., $12,000. Noted Aug. 14.

South Carolina — State Hy. Dpt., Columbia, paving 10.3 mi. hy. Marlboro Co., to Simons-Mayrant Co., Charleston, $205,540—33.4 mi. Georgetown Co., to Roberts Paving Co., Salisbury, Md., $778,811 — 8.6 mi. Colleton and Dorchester Counties, to Powell Paving Co. of North Carolina, Winston-Salem, N. C., $280,442—13.2 mi. Abbeville and Greenwood Counties and 11.8 mi. Chesterfield Co., to Pennell & Harley, Spartanburg, $288,214 and $246,222 respectively—13.6 mi. Fairfield Co. and 14.1 mi. Lexington Co., to Ballenger Paving Co., Greenville, $280,418 and $292,246 respectively—11.3 mi. Colleton Co., to Davis Constr. Co., Rhodes-Haverty Bldg., Atlanta, Ga., $247,686—17.1 mi. Lancaster and Kershaw Counties and concrete paving 10.2 mi. Clarendon Co., to Pittman Constr. Co., Rhodes Bldg., Atlanta, Ga., $403,923 and $235,884 respectively—paving 0.404 mi. Beaufort Co., to Espy Paving & Constr. Co., Savannah, Ga., $12,145—surface treating 49.6 mi. Allendale, Barnwell and Aiken Counties, to Carolina Road Surfacing Co., Greenville, $291,793—6.7 mi. Marlboro Co., to Harwell Bros., Columbia, $62,046—grading 15.5 mi. Union and Newberry Counties, to Chandler Bros., Virgilina, Va., $107,794—15.4 mi. Greenwood Co., to C. M. McKenzie, Abbeville, $75,923—17.7 mi. Horry Co., to Brantley & Crawley Constr. Co., Banks, Ala., $86,013 — grading, sand clay surfacing 15.5 mi. Bamberg and Orangeburg Counties, to J. F. Cleckley, Cope, $83,256. Grand total $3,978,356. Noted July 17.

S. D., Flandreau—City, paving streets, to Booth & Olsen, Sioux City, Ia., $35,035.

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WHERE STRENGTH IS ESSENTIAL

WHEN tested in piers, Brixment mortar approaches straight 3-to-1 portland cement mortar in strength.

And since Brixment is more plastic, is ground finer and hardens more slowly, it insures a better bond and more thorough bedding of the brick.

Ideal for foundation, load-bearing or parapet walls and even for tall, free-standing stacks. Louisville Cement Company, Incorporated, Louisville, Kentucky.

CEMENT MANUFACTURERS SINCE 1830

BRIXMENT

For MASONRY and STUCCO

Streets and Roads (Continued)

Tennessee — State Dpt. Hys. and P. Wks., Nashville, grading 1.4 mi. hy. Hamilton Co., to Brown Constr. Co., 706 Manning St., Chattanooga, $60,357—5.932 mi. Montgomery Co., to Bradley & Wilson, Kevil, Ky., $21,588 — 10,661 mi. Henderson Co., to Everglades Constr. Co., Hilaleah, Fla., $139,587—constructing 2 bridges in Coffee Co., to Hagen-Bagley Constr. Co., Fayetteville, $39,001. Grand total $260,533. Noted July 24.

EXCAVATION, DRAINAGE, IRRIGATION, LEVEES, RIVER AND HARBOR

PROPOSED WORK

Ind., South Bend—Comrs. St. Joseph Co., constructing Coquillard Drainage Ditch. $26,420.

BIDS ASKED

Ala., Birmingham—Sept. 10, by A. J. Hawkins, city engr., earth and rock excav. in Sects. 1 and 2 Valley Creek Drainage Project; adv. E. N.-R. Aug. 21.

Calif., San Francisco — See "Streets and Roads."

Ill., Taylorville—Aug. 15, by Clear Creek Special D. D., c/o A. M. Bloxam, co. clk., 11.8 mi. excavating. J. W. Dappert, Taylorville, engr.

Kan., Council Grove—Aug. 28, by R. M. Armstrong, city clk., dredging, clearing channel, flood protection work Neosho River and Elm Creek. $100,000. Black & Veatch, 701 Mutual Bldg., Kansas City, Mo., engrs. Noted July 31.

New York—Sept. 2, by R. D. Hayes, comr. Canals, Waterways, State Office Bldg., Albany, placing quarry stone protection along canal banks, at Locations 1 and 2, near Montezuma, Erie Canal, est. $25,284, adv. E.N.-R. Aug. 21.

Tex., Houston—Aug. 27, at office City Secretary, new channel bridges, structures, for Buffalo River and Franklin Avenue Extension. W. F. Monteith, mayor.

CONTRACTS AWARDED

Ind., Frankfort — Comrs. Clinton Co., constructing Chas. D. McClamrock main drain and tributaries, to R. Riese, Milwaukee, Wis., $40,255; Wm. H. Irwin Drain, to General Dredging Co., Ft. Wayne, $10,500; Lick Run Drain, to Bremen Dredge & Excavating Co., Bremen, $8,966. Grand total $59,721.

Okla., Purcell — McClain Co. draining, straightening Walnut Creek, incl. 1,000,000 cu.-yd. excav., to J. D. Maun Co., Petroleum Bldg., Oklahoma City, $176,680. Est. $178,000. Noted Aug. 7.

British Columbia—N. Desjardins, secy., Dpt. P. Wks., Ottawa, Ont., dredging Fraser River, North Arm, to B. C. Bridge & Dredging Co., Standard Bank Bldg., Vancouver, $150,000. Noted July 10.

Ontario—N. Desjardins, secy. Dpt. P. Wks., Ottawa, dredging Port Arthur and Fort William, to Great Lakes Dredging Co., Whalen Bldg., Port Arthur, $150,000. Noted May 22.

Public Bond Elections

Coming Bond Elections

Waterworks Dist. System, Etc.—Arcadia, Calif., exceeds $25,000.

Waterworks — Holdenville, Okla., Aug. 26, $225,000.

Sewers—Los Angeles, Calif., $2,500,000.

Power Plant — Paragould, Ark., Sept. 21, $125,000.

Court House—Potter County, Texas, Aug. 30, $420,000.

Bonds Voted

Waterworks Extensions — Scranton, Iowa, $30,000.

Waterworks—Indianola, Miss., $20,000.

Sewage Disposal Plant—Cordell, Okla., $39,000.

Sewage Disposal Plant — Wilmar, Minn., $160,000.

Sanitary Sewerage System — Weimar, Tex., office addition. Taking bids on boring.

FEDERAL GOVERNMENT

PROPOSED WORK

California—BRIDGE—U. S. Forest Service, San Francisco, State, Sacramento and Siskiyou Co., plans steel bridge over Klamath River, near Walker. $25,000.

Conn., New London—ACADEMY—U. S. Coast Guard Academy, plans academic building, cadets barracks, enlisted men's building, gymnasium drill hall, officers quarters, hospital, shops and power plant, Mohegan Ave. Private plans.

Ind., Indianapolis — HOSPITAL — U. S. Vet. Bureau Arlington Bldg., sketches Hospital, Riverside Park, East Riverside Dr. and Burdsal Blvd.

Md., Annapolis—PISTOL BUTTE—Spec. 6254—Yards & Docks, Navy Dpt. extending pistol butte, at Naval Academy.

Mass., Boston—RIP RAP STONE—U. S. Eng. plans 11,000 tons rip rap stone north and south bank, Cape Cod Canal.

Mass., Lawrence—POST OFFICE—Treas. Dpt. at office Sup. Archt., 1 story, basement, post office addition. Taking bids on borings.

Mo., Kansas City—PILE DIKES—U. S. Eng. 21,460 lin. ft. standard pile dikes or hurdle dikes and 5,800 lin. ft. standard revetment in Missouri River at Wilhoite Bend.

Nev., Hawthorne — PIPING — Spec. 6156 — Yards & Docks Navy Dpt. water supply piping and concealed lawn sprinkling system, at Naval Ammunition Depot.

N. Y., Buffalo—RETAINING WALL—U. S. Eng. plans 298 ft. steel sheet pile retaining wall at Black Rock.

Pa., Donora—LOCK and DAM—U. S. Eng., Pittsburgh, plans concrete and steel, lock and dam, down stream from present Lock 4.

R. I., Melville — GENERATOR SET — Spec. 5715—Yards & Docks, Navy Dpt., removing and reinstalling 3 generator sets and furnishing 4 boilers with set oil pumping units.

Va., Norfolk — SURFACING FIELD — Spec. 6270—Bureau Yards & Docks, Navy Dpt. plans surfacing flying field, at Naval Operating Base.

Wash., Bellingham—DREDGING—U. S. Eng., Seattle, dredging 26,000 cu.yd. silt and gravel at Whatcum Creek, Bellingham Harbor.

BIDS ASKED

Calif., San Diego—PIER—Spec. 6239—Sept. 3, by Yards & Docks, Navy Dpt. extending rein.-con. pier, Naval Operating Base.

D. C., Wash.—DIESEL ENGINES—Sept. 5, by A. L. Flint, genl. purch. agent, Panama Canal, diesel engines. Schedule 2580.

D. C., Wash.—DUMP CARS—Aug. 28, by A. L. Flint, genl. purch. agent, Panama Canal, dump cars and track pump units, press numbering machines, steel, iron, pipe, boiler tubes, brass copper, nickel alloy. Schedule 2579.

D. C., Wash.—OFFICE—Sept. 1, by U. S. Capitol, house office annex.

Ga., Savannah—PROTECTION WORKS—Aug. 29, by D. L. Weart, dist. engr., U. S. Engineers Office, P. O. Bldg., shore protection works on eastern shore, Fort Screven reservation on Tybee Island. Noted Aug. 14.

Md., Fort George Meade—OFFICERS QUARTERS—Sept. 3, at office of Con. Q. M., constructing, completing 12 sets officers' quarters and 6 sets non-commissioned officers' quarters; adv. E. N.-R. Aug. 21.

Mass., Boston—CABLE—Aug. 26, by Bureau Supplies Accounts, electric cable for Boston Navy Yard.

Missouri—LEVEE—Sept. 8, at office U. S. Engineer, Rock Island, Ill.; enlarging levee in Marion Co. Drainage Dist.; adv. E. N.-R. Aug. 21.

Missouri—PILE CLUMP DIKES—Aug. 27, by U. S. Engineer Office, Kansas City, 21,460 lin.ft. pile clump dikes, and 5,800 lin.ft. standard revetment in Missouri River at Wilhoite Bend, center of work at Cambridge.

Nev., Hawthorne—STABLE and CORRAL—Spec. 6197—Sept. 10, by Bureau Yards & Docks, stable and corral.

N. Y., Fort Hamilton (sta. Brooklyn)—MONUMENT—Spec. 6203—Aug. 27, by Bureau Yards & Docks, Navy Dpt., Wash., D. C., monument in Fort Hamilton Park; adv. E. N.-R. Aug. 21.

N. Y., New York—DREDGING—Sept. 17, by U. S. Eng., Army Bldg., 39 Whitehall St., dredging 24,150 cu.yd. material other than ledge rock and 93,055 cu.yd. ledge rock in East River; adv. E. N.-R. Aug. 21. Noted Aug. 7.

N. Y., Plattsburg—BARRACKS—Sept. 3, by Con. Q.M., Plattsburg Barracks, constructing hospital detachment barracks; adv. E. N.-R. Aug. 21. Noted Aug. 7.

Okla., Tulsa—REMODELING—Sept. 16, by Treas. Dpt. at office Sup. Archt., remodeling, extending (except elevators) U. S. Post Office and Court House.

R. I., Providence—DREDGING—Sept. 19, at office U. S. Engineer, 1,230,400 cu.yd.; adv. E. N.-R. Aug. 21.

Wis., Milwaukee—RIP RAP, STONE, etc.—Aug. 29, by Superintendent Lighthouses, rip rap, stone for Calumet Breakwater Light Station, South Chicago, and East Pierhead Light Station, Michigan City, Ind.; adv. E. N.-R. Aug. 21.

CONTRACTS AWARDED

Arkansas—LEVEE—U. S. Eng., Vicksburg, Miss., to McWilliams Dredging Co., 75 East Wacker Dr., Chicago, Ill., 647,000 cu.yd. levee in Lower St. Francis Levee Dist. $114,843. 685,000 cu.yd. Lower St. Francis Levee Dist. $163,000; Southern Dredging Co., Inc., Memphis, Tenn., 306,000 cu.yd. Piece 22A, $99,144; to Lowrance Bros. & Co., Driver, Ark., 1,800,000 cu.yd. Pieces 26A and B, $410,400; to H. E. Culbertson, Cleveland, O., 355,000 cu.yd. Upper Yazzo Levee Dist. Piece 29A $86,407, 550,000 cu.yd. Piece 29B $133,870, 450,000 cu.yd. Piece 29C $109,530, 510,000 cu.yd. Piece 29D $124,134. Grand total $1,241,328. Noted July 21 "Daily."

D. C., Wash.—STEAM DISTRIBUTION SYSTEM—Spec. 6221—Yards & Docks, Navy Dpt. steam heating lines at Naval Hospital to Mechanical Eng. Constr. Corp., 519 Mills Bldg., $8,325. (60 days). Noted July 24.

Illinois—EARTHWORK—U. S. Eng., Memphis, Tenn., 800,000 cu.yd. earthwork on Ohio River to A. Guthrie & Co., Inc., 1209 Builders Exchange Bldg., St. Paul, Minn., $296,000. Noted July 24.

Kan., Wichita—POST OFFICE—Treas. Dpt. at office Sup. Archt., U. S. Post Office and Court House, to Murch Bros. Constr. Co., Railway Exch. Bldg., St. Louis, Mo., $994,000; elevators, to Otis Elevator Co., 810 18th St., N.W., $33,337. Noted July 3.

N. Y., Peekskill—POST OFFICE—Treas. Dpt. at office Sup. Archt., constructing U. S. Post Office to Ring Constr. Co., Minneapolis, Minn., $104,600. Noted July 17.

N. Y., White Plains—POST OFFICE—Treas. Dpt. at office Sup. Archt., constructing U. S. Post Office, to MacDonald Constr. Co., Syndicate Trust Bldg., St. Louis, Mo., $174,359. Noted July 17.

Oregon—BRIDGE—U. S. Bur. P. Rds., Portland, bridge on Salmon River Hy., Lincoln Co. to Teller Constr. Co., Portland, Ore., $46,966.

R. I., Newport—POWER PLANT—Spec. 6031—Yards & Docks, Navy Dpt. power plant building at Naval Fuel Depot to Coleman Constr. Co., 86 Weybosset St., Providence, $42,317 (240 days). Noted July 24.

Tenn., Kingsport—POST OFFICE—Treas. Dpt. at office Sup. Archt., constructing U. S. Post Office, to Beaman-Coleman Constr. Co., Raleigh, N. C., $11,900. Noted July 3.

Tenn., Memphis—ROADS—U. S. Eng., roads, bridges, culverts in connection with Bird's Point-New Madrid Floodway Drainage System, to Forcum-Jones Constr. Co., Dyersburg, $130,000. Noted July 10.

Tenn., Memphis—SPILLWAY—U. S. Eng., constructing Brewer's Lake outlet structure and concrete culvert under U. S. Highway 60 to J. J. McCaughney Co., and State Contg. Co., 205 West Wacker Dr., $19,408. Noted July 31.

Tex., Randolph Field—HANGARS—Con. Q. M. eighteen 110 x 220 ft. airplane hangars to K. L. Colborn, Inc., Pasadena, Calif., $556,820, Noted July 10.

Va., Hampton Roads — DREDGING — Spec. 6223 — Yards & Docks, Navy Dpt., dredging at Naval Operating Base, to Arundel Corp., Pier 2, Pratt St., Baltimore, Md., est. $100,000.

Va., Norfolk—DREDGING—U. S. Eng. dredging 1,425,382 cu.yd. in James River to Delaware Dredging Co., 139 South 3rd St., Phila., Pa., $124,293. Noted July 10.

Wyoming—ROAD—Bureau P. Rds., Denver, Colo., grading, surfacing, 6.137 mi. Jackson-Wind River Natl. Forest Rd., Teton Natl. Forest, Teton Co., to Threet Bros., Lowell, $70,723. Noted June 26.

RAILWAYS

PROPOSED WORK

Texas—Southern Pacific Co., Pacific Lines, G. W. Boschke, ch. engr., San Francisco, Calif., plans 110 mi. railroad between Fredericksburg, Mason, Brady, Eden and San Angelo. $5,500,000. Private plans.

BIDS ASKED

Nevada — Sept. 5, by Union Pacific System, H. C. Mann, ch. engr., Omaha, Neb., grading, trestles, culverts 22 mi. branch railroad, from point on main line 7 mi. south of Las Vegas, to Summit.

GRADE CROSSINGS

BIDS ASKED

Ga., Columbus—See "Bridges."

CONTRACTS AWARDED

N. Y., Hamburg—New York Central R.R. Co., F. B. Freeman, ch. engr., 466 Lexington Ave., New York, New York, Chicago & St. Louis R.R., A. C. Harvey, ch. engr., Terminal Bldg., Cleveland, O., Buffalo & Erie R.R. Co., and Pennsylvania R.R. Co., T. J. Skillman, ch. engr., Broad St., Phila., Pa., eliminating Athol Springs Road Crossing, to Bates & Rogers Constr. Co., 2207 Ontario Ave., Cleveland, O., $111,143.

DAM

PROPOSED WORK

Ia., Osceola—See "Waterworks."

CONTRACTS AWARDED

B. C., Ruskin—British Columbia Electric Ry. Co., 425 Carroll St., Vancouver, seven 26 x 33 ft. Taintor control gates for Ruskin Dam, to Western Bridge Co. Ltd., 1st Ave. and Columbia St., Vancouver, $65,000.

PIERS AND WHARVES

CONTRACTS AWARDED

Que., Carlton—WHARF—Dpt. P. Wks., Ottawa, Ont., extending wharf, to Farley & Grant, Rideau Natl. Bank Bldg., Ottawa, Ont., $26,000.

AIRPORTS

CONTRACTS AWARDED

La., Baton Rouge—East Baton Rouge Police Jury Parish, administration building, hangar, to A. C. Stewart, Baton Rouge, $50,602; plumbing and heating, to State Plumbing & Heating Co., Baton Rouge, $2,156; electrical work, to Baton Rouge Electric & Machine Co., Baton Rouge, $3,600. Grand total $56,358. Reported incorrectly under Ia., Baton Rouge, in Aug. 7 issue.

La., Natchitoches — City, 1 story, 80 x 100 ft. brick, steel hangar at municipal airport, to P. Prudhomme, Natchitoches, $12,176. Noted Sept. 12.

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Airports (Continued)

Miss., Meridian — City, improving airport, incl. 1 story, 94 x 101 ft., brick, concrete hangar, 2 story, 33 x 66 ft., administration building, to J. D. Watkins & Son, Meridian, $23,975. Noted June 19.

Neb., North Platte—Boeing Air Transport, Inc., D. B. Colyer, vice pres., foot Cook St., Omaha, 80 x 100 ft., brick, steel hangar to Austin Co., 16112 Euclid Bldg., Cleveland, O., $40,000.

Neb., Omaha—Boeing Air Transport, Inc., D. B. Colyer, vice pres., foot Crook St., Omaha, 80 x 104 ft., brick, concrete, steel, hangar to Austin Co., 16112 Euclid Bldg., Cleveland, O., $65,000.

O., Cleveland—Concrete paving 28,060 sq.yd. Runway at Cleveland Airport, to Baldwin Bros., Union Trust Bldg., $82,615.

POWER AND LIGHTING

PROPOSED WORK

Okla., Woodward—City preliminary plans gas system, $75,000. H. M. Renner, Woodward, engr.

Utah, Nephi—Telluride Power Co., Walker Bank Bldg., Salt Lake City, plans 65 mi. 44,000 v. transmission line from here to Delta. $65,000. H. B. Waters, genl. mgr.

BIDS ASKED

Calif., Porterville — W. R. Means, city clk., taking bids 2-light type metal standards for electrolier system on Main St. $25,000 or more. F. Pease, city engr.

New York — Aug. 25, by Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville, electric lighting on Saw Mill River Parkway, from Ashford Ave., Dobbs Ferry to Tarrytown Rd., Elmsford. J. Downer, engr.; adv. E. N.-R. Aug. 14.

CONTRACTS AWARDED

Calif., San Francisco—See "Sports and Parks."

Texas—Southwestern Public Service Co., subsidiary Commonwealth Power Corp., 120 Bway., New York, high power tension line from Amarillo, to Tascosa and tie into line of Texas Utilities Co. $250,000. Owner builds. C. Cox, genl. supt., in charge company forces.

SPORTS AND PARKS

PROPOSED WORK

Mass., Boston — City, Park Dpt., 33 Beacon St., rock garden at Franklin Park. $25,000 or more.

Mass., West Roxbury (sta. Boston)—City of Boston, Dpt. P. Wks., J. A. Rourke, comr., Boston, plans playground, Popular and Dale Sts., $30,000.

BIDS ASKED

Mass., South Boston (sta. Boston)—City of Boston, Park Dpt., 33 Beacon St., Boston, bids about Sept. 1, 2 story, basement, brick, rein.-con., steel bath house, Columbia Rd. at L St. $350,000. J. M. Gray & J. P. Hefferman, 175 High St., Boston, archts.

Mich., Detroit—Aug. 22, by C. A. Gadd, bus. mgr. Bd. Educ., rein.-con., tile swimming pool in Southeastern High School, Fairview Ave. $25,000.

CONTRACTS AWARDED

Calif., San Francisco—San Francisco Baseball Club, 15th and Valencia Sts., rein.-con., steel baseball grandstand, night baseball lighting system, to Lindgren-Swinerton, Inc., 225 Bush St., $1,250,000.

Mass., Boston—City Park Dpt., 33 Beacon St., 1 story, brick, concrete field house, Webster Avenue, playground, to F. Losodoro Co., 24 School St., est. $25,000. Noted July 31.

Mo., St. Louis — Forest Park Highland Exhibition & Amusement Co., B. C. Brinkman, pres., 5600 Oakland Ave., will build 118 x 268 ft. ice rink for arena, 5700 Oakland Ave., under supervision R. C. McCoy, engr., Tulsa, Okla., engr.

N. Y., New York—J. Miller, pres. Manhattan Boro, Municipal Bldg., general contract natatorium at Carmine Street Bath, to F. R. Green & Co., Inc., 215 4th Ave., $93,000. Noted

HEATING AND VENTILATING

BIDS ASKED

Ind., Indianapolis — Aug. 29, by Comrs. Marion Co., plumbing, heating at Julietta Hospital for Insane. $25,000. C. H. Byfield, 923 Peoples Bank Bldg., archt.

Mass., Cambridge—Harvard University, A. L. Lowell, pres., taking bids heating and ventilating, electrical work, plumbing in 3rd unit, dormitory group, Boylston St. and Memorial Dr., each foregoing to exceed $25,000. Coolidge, Shepley, Bulfinch & Abbott, Ames Bldg., Boston, archts.

N. Y., Marcy—Sept. 3, by Dpt. Mental Hygiene, State Office Bldg., Trenton, covering heating work, sanitary work, equipment for kitchen equipment, Tuberculosis Pavilion, Marcy Div., Utica State Hospital; adv. E. N.-R. Aug. 21.

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N. Y., Newark—Sept. 3, by Dpt. Mental Hygiene, State Office Bldg., Albany, heating work, sanitary work and equipment for kitchen equipment, dining room and service building. Newark State School; adv. E. N.-R. Aug. 21

N. Y., Rome—Aug. 29, by Commissioner Dpt. Educ., State Education Bldg., Albany, heating, work for new boilers, Central New York Institution for Deaf Mutes; adv. E. N.-R. Aug. 21.

CONTRACTS AWARDED

Ala., Gadsden — Missionary Servants of the Blessed Trinity, Holy Trinity, two 125 hp., 150 lb., H. R. T. boilers, 7,500 sq.ft. radiation, wrought iron, steel, brass pipes, pumps, plumbing fixtures, at hospital, to Mason & Dulion, 3024 3rd Ave., S., Birmingham. Noted July 17 under "Hospitals—Contracts Awarded."

Me., Ellsworth—Comrs. Hancock Co., heating and ventilating, courthouse, to E. C. Eldridge, Ellsworth. Est. $25,000. Noted May 29 under "Public Buildings."

Mass., Boston—Hospital Dpt., heating, plumbing, refrigeration, electrical work in Nurses Home, South Dpt., City Hospital, to John Bowen Co., 129 Newbury St. Est. $80,000. Noted July 31.

Mass., Lynn—City, D. Dineen, in charge, City Hall, heating, plumbing in police station, garage and boiler house to be erected, to R. T. Pender, 3 Sutton St., $33,500. Noted Aug. 7 under "Public Buildings."

Pa., Pittsburgh—R. G. Woodside, controller, Allegheny Co., electrical work for County Office Bldg., to Sargent Eng. Co., Thaw Bldg., $36,975—plumbing, to Iron City Plumbing Co., 527 1st Ave., Pittsburgh, $18,650—laboratory ventilation, to F. E. Geisler & Co., 424 1st Ave., $15,840. Grand total $84,115.

R. I., Warwick—Town, C. Christie, 1044 Main St., heating, ventilating and plumbing in Centerville Road School, to R. Renaurd, 56 Cumberland St., Woonsocket. Est. $25,000.

UNCLASSIFIED

PROPOSED WORK

Fla., New Smyrna — BULKHEAD — See "Garages."

Mass., Adams—TOWER—Commonwealth of Massachusetts, War Memorial Comn., W. H. Eaton, chn., sketches by Maginnis & Walsh, Statler Bldg., Boston, Beacon Memorial Tower on Mt. Greylock. To exceed $25,000. Noted Aug. 14.

N. J., Bound Brook—RADIO BROADCASTING PLANT—C. MacKenzie, archt., 119 Broad St., New York, soon lets contract 1 story addition to radio broadcasting plant, 1 story cooling plant 1 story garage for Radio Corp. of America, 233 Bway., New York, $40,000.

BIDS ASKED

N. Y., New York—ELECTRIC WIRING—Aug. 25, by M. Cosgrove, comr. Docks, Pier A, foot of Battery Pl., North River, Contr. 1929-D (revised), electric wiring, fixtures for shed for Pier New 3, North River.

CONTRACTS AWARDED

Ind., Clermont — TUNNEL — Bd. Trustees Indiana Girls School, 1,600 ft., 5 x 6 ft., concrete service tunnel, to G. A. Sheeham, Brazil. Est. $25,000.

Ind., Muncie—GAS PIPE LINES—See "Factories and Mills."

Mass., New Bedford — CONCRETE WALL — Standard Oil Co. of New York, Park Sq. Bldg., Boston, 360 ft. concrete wall, 17 ft. high, Fish Island distribution plant, to W. H. Noonan, 191 Mauren Ave., East Providence, R. I.

N. J., Ocean City—BULKHEADS—Bd. City Comrs., City Hall, timber bulkheads at Bay from 13th and 14th Sts. to East Coast Constr. Co., Ocean City, est $25,000.

N. Y., Brooklyn—COAL POCKET—Checo Corp., 3rd St., coal pocket, to Nicholson Co., 405 Lexington Ave., New York, est. $25,000.

N. Y., Brooklyn—DEPOSIT VAULTS—Bank of American National Association, 44 Wall St., New York, safe deposit vaults at Nassau National Bank, 16 Court St. to W. Kennedy Constr. Co., 215 Montague St., est. $150,000.

Wyoming — GAS PIPE LINE — Sheridan Gas & Fuel Co., Sheridan, 90 mi. 6 in. gas line from Billy Creek gas field to Sheridan, via Buffalo, to Hope Eng. Co., Mount Vernon, O.

MATERIALS

BIDS ASKED

BRIDGE LUMBER—**Atlantic, Ia.**—Sept. 1, at office Auditor, Cass Co., bridge lumber and snow fence.

STEAM CINDERS—**Brooklyn, N. Y.**—Aug. 27, by H. Hesterberg, pres. Brooklyn Boro, 15,000 cu.yd. steam cinders; 100,000 gal. asphalt road oil for cold application, to be delivered by rail to any or all railroad stations in boro as engineer directs; 2,000 bbl. cement.

PIPE, PIPE FITTINGS, etc.—**New York, N. Y.**—Aug. 29, by P. J. Dooling, comr., Purchase, Municipal Bldg., pipe, pipe fittings, valves, engineer's, plumber's and steam fitter's supplies to Police Dpt., Departments of Correction, Water Supply, Gas and Electricity, Plant and Structures, and Parks, Bronx Boro.

CONTRACTS AWARDED

PILES—**Los Angeles, Calif.**—City Harbor Dpt manufacturing concrete bearing piles, sheet piling, concrete wales for wharf at Berths 144 145, 146, to Pan-Pacific Piling & Constr. Co 530 West 6th St., $186,263.

EQUIPMENT

BIDS ASKED

RECORDING WATT-HOUR METERS — **Jacksonville, Fla.** — Sept. 17, by M. W. Bishop city secy., 1,000 more or less induction recording watt-hour meters, single and multiphase for 110 and 220 volts, 60-cycles on basis of 12 mo. future delivery f.o.b. electric substation, here.

Buildings

RESIDENTIAL

BIDS ASKED

Kan., Abilene—A. H. Gentry, archts., 1010 Fairfax Bldg., Kansas City soon lets contract 7 story, basement, 100 x 120 ft., brick, rein.-con., stone, hotel, for Abilene Hotel Co., Abilene $150,000. Noted Dec. 19.

N. J., Asbury Park—B. and S. Land Co., 137 South Broad St., Newark, taking bids 5 story basement, brick, steel, plain found. $150,000 Private plans.

N. J., East Orange—Harris & John, archts., 7 Mechanic St., Newark, taking bids 3 and 4 story, basement, 50 x 200 ft., brick, steel, plain found., Irvington Ave., for Morris Mandelbaum Associates, 7 East 42nd St., New York, $200,000.

N. Y., New York—See "Contracts Awarded."

Wis., Milwaukee—Owner c/o R. B. Williamson, archt., 405 Bway., soon lets contract 3 story, basement, 116 x 140 ft., brick, steel, Green Bay St.

CONTRACTS AWARDED

Calif., Los Angeles — Villa Rapallo Holding Co., 5 story, basement, 57 x 140 ft., rein.-con. brick, steel, Crescent Heights Blvd. and Norton Ave., to J. B. Dawson, 950 South Wilton Pl., $300,000.

Calif., Los Angeles—E. A. Kassing, 1745-B Gramercy Pl., 7 story, basement, 85 x 165 ft., rein.-con., North Gramercy Pl., to A. J. Showalter, 1534 North Harper Ave., $250,000.

N. Y., Brooklyn—H. Barba, 11 West 42nd St., New York, 6 story, brick, East 18th St. $156,000. Owner builds. J. Martine, 545 5th Ave., archt.

N. Y., New York—Bandes Stillman Constr. Co., 2419 Webster Ave., 6 story, 109 x 146 ft., brick, River Ave. and 153rd St. $250,000. Separate contracts. N. Rotholz, 2410 Webster Ave., archt.

CLUBS

PROPOSED WORK

Ark., Little Rock — Little Rock Boys Club Building Co., c/o J. C. Conway, American Exchange Trust Co., chn. bd., plans by Thompson, Saunders & Ginocchio, Hall Bldg., and Wittenberg & Deloney, Home Insurance Bldg., 3 story, rein.-con., brick, 8th and Scott Sts. $150,000.

Conn., Bridgeport — Algonquin Club, 211 State St., plans by F. J. Dixon, State St., brick, steel, clubhouse, Harrison and Golden Hill Sts. $200,000. Noted July 24.

Ill., Alton—Alton Y. W. C. A. c/o Bd. Dir., F. Senn, genl. secy., soon lets contract 3 story, basement, brick, steel, Y. M. C. A. building. $175,000. LeBeaume Klein, 16 Amer. Trust Bldg., St. Louis, Mo., archt.

Ill., Chicago—Motorists Association of Illinois, 3254 South Michigan Ave., plans 9 story, 118 x 173 ft. by Michaelson & Rognstad, 3256 Franklin Blvd., club and office, 2400 South Michigan Ave. $1,500,000. Noted June 19.

Ia., Dubuque—Masonic Temple Assn., G. L. Dewey, secy., P.O. Box 165, rejected bids July 23, 4 story, mezzanine, 100 x 159 ft., rein.-con., brick, steel, stone masonic temple, 12th and Locust Sts. $250,000. R. F. Moore, 415 O.R.C. Bldg., Cedar Rapids, archt. Noted May 1.

Mass., Boston—Boston Young Mens Christian Union, 39 Boylston St., brick, stone club house, Park Sq., Eliot and Carver Sts. To exceed $150,000. Architect not selected.

Mass., Brockton—C. T. Olson, 101 Main St., sketches clubhouse, 187 Court St. $150,000 or more.

N. J., Freehold — Knights of Columbus, sketches by E. H. Schmeider, 3rd Ave., Spring Lake, 2 story, basement, brick, steel, club house. $150,000.

N. Y., New York—American University Club, sketches by Bottomley, Wagner & White, 60 East 42nd St., 40 story, club. $8,000,000. **Maturity in six months.**

Pa., Bradford—Tuna Lodge 411 100f, J. Polley, chn. Building Co., 111 High St., plans by T. K. Hendryx, 15 Tidewater Bldg., 5 story, basement, 82 x 96 ft., brick, steel, incl. offices, stores, 2-8 Main St. $175,000.

Pa., Pittsburgh—Y. M. C. A., 3rd and Wood Sts., raising $600,000, for following buildings, improvements, Homewood Brushton Branch, new

Clubs (Continued).

building near Kelly and Homewood Aves., $100,000, incl. furnishings; Oakland Branch, new community building, $148,000, incl. furnishings; Camp Kon-O-Kwee, near Zelionople, Perry Hy., $73,000, incl. equipment; North Borough Branch, Lincoln Ave., remodeling, swimming pool, $90,000, incl. furnishings; also improvements, equipment at Camp H. Kirk Porter $21,000, East Liberty Branch $65,000, Hill Top Branch $36,000, Center Avenue Branch $75,000, and Downtown Branch $25,000. Architect not selected.

BIDS ASKED

N. J., Hohokus—P. J. Jossier, archt., 240 Broad Ave., bids about Oct. 1, general contract and separate contracts 2 story, basement, 90 x 180 ft. golf club, for Owner. $200,000. Noted July 10.

N. J., Newark—G. E. Jones, archt., 24 Commerce St., taking bids general contract 2 story, basement, 50 x 175 ft., brick, steel, plain found., Read and Providence Sts. for Eight Hundred Twenty Five Holding Corp., c/o archt. $150,000.

N. J., West Caldwell—Aug. 24, by C. C. Wendehack, archt., 101 Park Ave., New York, general contract 2 story, basement, 115 x 220 ft., brick, plain found., for Mountain Ridge Country Club, West Orange. $200,000.

CONTRACTS AWARDED

Kan., Manhattan—Rebecca & Odd Fellows, c/o G. Hughes, Eldorado, 3 story, basement, 90 x 130 ft., brick, rein.-con., home addition, to P. H. Sanneman, Clay Center, $78,326; heating and plumbing, to Lyons & Gustafson, 117 East Walnut St., Salina, $14,990. Noted July 31.

HOSPITALS

PROPOSED WORK

Calif., Colusa—Colusa Co. plans by O. Deichmann, 110 Sutter St., San Francisco, 1 and 2 story, rein.-con. $250,000.

Calif., San Francisco—City and San Francisco Co., plans by S. Heiman, 57 Post St., 4 story, basement, rein.-con., steel health center, Polk and Grove Sts. $800,000.

Conn., Bridgeport — St. Vincents Hospital, 2820 Main St., plans by E. G. Southey, 955 Main St., brick, steel hospital wing, Main St. $500,000. Noted Apr. 18, 1929.

Conn., Rockyhill—Hartford Retreat, W. N. Thompson, supt., 400 Washington St., Hartford, plans brick, steel, administration, service, nurses and patients cottages for hospital community. Est. exceeds $150,000. Architect not selected.

Ind., Indianapolis — Riley Hospital, West Michigan St., plans by R. F. Daggett, 922 Continental Bank Bldg., 2 story, basement, 75 x 150 ft., rein.-con., stone, brick Rotation Unit of hospital. $200,000.

Mass., Harwich—Central Cape Hospital Trust, C. T. Chase, pres., sketches by E. T. P. Graham, 171 Newbury St., Boston, altering and constructing nurses home and administration building. Est. exceeds $150,000. Noted July 24.

Mass., Southbridge — Harrington Hospital Corp., C. D. Harrington, pres., soon takes bids 2 story, basement, brick, stone, steel, plain found., Oakes Ave. $200,000. Derby, Barnes & Champney, 3 Joy St., Boston, archts., and A. Franklin, Inc., 25 Haverhill St., Boston, engrs. Noted July 17.

Mich., Flint—Hurley Hospital plans by F. D. Madison, Royal Oak, 3 story, basement, concrete, brick, steel, stone addition, plain found. $175,000.

Neb., Grand Island—D. X. Murphy, archt., 707 Louisville Trust Bldg., Louisville, Ky., 4 story, basement, 46 x 89 ft. and 46 x 102 ft., concrete, brick, steel, stone, hospital addition and chapel, for Sisters of St. Francis, c/o archt. $400,000. Noted Apr. 24.

N. H., Littleton—Littleton Hospital, H. M. Eaton, pres., Bd. Trustees, altering and constructing hospital addition. $150,000. Architect not selected.

N. J., Browns Mills—Jewish Relief Society, M. J. Unger, ch., 24 Branford Pl., Newark, rejected bids May 5, general contract 4 story, basement, Deborah Sanitarium, $600,000. F. Grad, 1023 Broad St., Newark, archt. Noted Apr. 24.

Tex., El Paso—El Paso Co. election about Sept. 1, $600,000, fireproof hospital plant. Address County Engineering Dpt., El Paso.

BIDS ASKED

Mass., Malden (br. Boston)—Aug. 25 (extended date), by Kendall, Taylor & Co., archts., 209 Columbus Ave., Boston, 3, 4 and 5 story, basement, irregular sized, brick, stone, steel, concrete hospital group, plain founds., Hospital Rd., for Malden Hospital, E. P. Bliss, chn. Comn. in charge. Est. $1,200,000. Electrical work, heating and ventilating, plumbing, est. to exceed $25,000 each. Noted July 17.

CONTRACTS AWARDED

Ala., Gadsden—General Hospital Corp., H. J. Savage, chn. Building Com., 3 story, brick, stucco, rein.-con., stone, to W. H. Mayben, Gadsden, $250,000.

Calif., Los Angeles—Santa Fe Hospital Assn., 610 South St. Louis St., 3 story, basement, rein.-con. dormitory, 6th and Louis Sts., to Lynch Constr. Co., 730 Merrill St., $175,000.

Calif., San Bernardino — Sisters of Charity, 200 x 200 ft., rein.-con., to F. J. Solt, California Hotel, $650,000. Noted July 17.

Ga., Columbus — City, c/o H. B. Crawford, mgr., 4 story, basement, 40 x 94 ft. hospital addition, and 2 story, basement, 50 x 55 ft. nurses home, brick, to J. P. Bradfield, Glade Rd., $150,000.

Ky., Lexington — Good Samaritan Hospital, general contract 4 story, basement, 43 x 126 ft. with 13 x 42 ft. wing, Georgian design, Bowling Green limestone, to Wortham Constr. Co., Starks Bldg., Louisville, $211,000.

Md., Baltimore—Bd. Awards, City Hall, 10 story, T-shaped, brick, concrete, steel nurses home, to North-Eastern Constr. Co., 6 West Madison St., $680,000. Noted July 31.

Mass., Roxbury (br. Boston)—Childrens Hospital, G. Von L. Meyer, chn. building com., 53 State St., Boston, isolation and pathology unit Vila St., to Turner Constr. Co., 178 Tremont St. Boston; heating and ventilating, to Cleghorn Co., 86 Broad St., Boston, est. $250,000. Noted July 24.

Mich., Eloise — Wayne Co. Auditors, Detroit, rein.-con., brick, steel, stone infirmary, Michigan Ave., to A. W. Kutche Co., 2211 Woodward Ave., Detroit, $603,608.

Mo., Richmond Heights—St. Mary's Hospital, c/o Sister Irene, 642 Clayton Rd., 6 story, basement, 35 x 125 ft., brick, rein.-con., stone hospital addition, nurses home and school, 6420 Clayton Rd., to Wimmer Contg., 916 Victoria Bldg., St. Louis.

Okla., Norman—Central State Hospital, c/o State Bd. Affairs, State House, Oklahoma City, 3 story, basement, brick ward building, plain found., to Richter & Lail, Pauls Valley, $137,980. Noted July 31.

Wis., Waukesha—Milwaukee Childrens Hospital Assn., 167 17th St., W., Milwaukee, 1 and 2 story, 34 x 125 ft. and 34 x 100 ft., brick children's hospital, plain found., in Waukesha Co., to E. S. Steigerwald & Son, 5310 State St., Milwaukee. Est. $25,000.

CHURCHES

PROPOSED WORK

Conn., Manchester — Methodist Episcopal Church, M. S. Stocking, pastor, 462 North Main St., church. $150,000. Architect not selected.

Conn., Waterbury—West Side Hill Methodist Episcopal Church, R. Shinn, pastor, revised plans by Bureau of Architects, 1701 Arch St., Phila., Pa., 2 story, basement, brick, stone, plain found., Main St. $150,000. Former bids rejected.

Ind., Ft. Wayne—Methodist Church plans by Bradley & Babcock, 221 West Wayne St., rein.-con., brick, steel Church, Forest and Kentucky Aves. $150,000.

Ind., Indianapolis — Bethlehem Lutheran Church, 52nd St. and Central Ave., plans by R. G. Foltz, rein.-con., stone. $150,000.

Ind., Indianapolis — Broad Ripple Christian Church, plans by A. A. Honeywell, 413 Pennway Bldg., brick, steel church, 62nd St. and Ashland Ave. $150,000.

Ia., Davenport—St. Pauls Lutheran Congregation, J. A. Miller, pastor, rejected bids 1 story, basement, rein.-con., brick. $125,000. H. S. Muesse, 925 American Bank Bldg., archt. Noted Feb. 13.

Mass., Attleboro — St. John the Evangelist Roman Catholic Church, J. M. Quinn, pastor, soon lets contract 1 story, basement, brick, stone, plain found., North Main St. $200,000. Maginnis & Walsh, Statler Bldg., Boston, archts. Noted Aug. 14.

Mass., Barnstable — West Barnstable Congregational Church Society-Hyannis, sketches by Parsons, Wait & Goodell, 1 Beacon St., Boston, 1 story, basement church, West Barnstable Rd. $150,000 funds being raised for same.

Mass., Lawrence—Anshe Sholem Synagogue, L. Pearl, Hampshire St., plans by J. G. Morrisette, 575 Essex St., and soon takes bids altering and constructing 1 story, basement, brick, steel, stone synagogue additino, plain found., Hampshire and Arlington Sts. $150,000.

Mass., Worcester — Hope Congregational Church, T. Foxall, pastor, plans church. $150,000 or more. Architect not selected.

Mo., Clayton — Central Presbyterian Church, c/o J. F. Green, ch., Building Comn., 1130 Boatman's Bank Bldg., St. Louis, bids late in August, 1 story, basement, rein.-con., brick, stone, church, auditorium and Sunday school, Hanley Rd. and Davis Pl. $300,000. Jamieson & Spearl, 1116 Arcade Bldg., St. Louis, archts. Noted May 29.

N. J., Fair Lawn—First Baptist Church, H. Schoener, Morlot Ave., plans 2 story, brick, steel, church and Sunday school. $150,000.

N. J., Fairview—Church of St. John Baptist, J. E. Kiernam, 235 Anderson Ave., Cliffside, sketches 2 story, basement, brick, steel, plain found., Anderson Ave. and Walker St. $150,000.

O., Cleveland — St. Vitus Roman Catholic Church, B. J. Ponikvar, pastor, plans by W. C. Jansen, 1227 Prospect Ave., 1 and 2 story, brick, steel, church and parish house, East 61st St. and Glass Ave. $150,000.

Pa., Phila.—Second Baptist Church of Germantown, Germantown Ave., plans by Druckenmiller & Williams, Otis Bldg., 1 and 2 story, basement, brick, steel, stone, Germantown Ave. and Upsal St. $250,000.

BIDS ASKED

Conn., Middletown—First Methodist Episcopal Church, M. J. Creeger, pastor, taking bids 1 and 2 story, basement, brick, stone church, plain found. $160,000. Woodbury & Stuart, 581 Boylston St., Boston, Mass., archts. Noted July 24.

B. C., Vancouver — Aug. 30, by Twizell & Twizell, archts., 837 West Hastings St., 2 story, 122 x 190 ft., granite, stone, Burrard and Nelson Sts., for United Church of Canada, Burrard and Georgia Sts. $200,000. Noted Jan. 23.

CONTRACTS AWARDED

Ind., Logansport—Presbyterian Church general contract brick, steel Sunday School, to C. R. Powlen, 509 8th St. Est. $150,000.

N. H., Nashua—Infant Jesus Parish, I. A. Janella, pastor, 2 story, basement, 60 x 135 ft., brick, stone, granite church and school, plain found., to LaChance Inc., 80 Boylston St., Boston Mass. Est. $150,000. Noted July 31.

O., Salem—St. Pauls Roman Catholic Church, M. J. Casey, pastor, brick, steel church, to Garrity & Parish, 144 West Wood St., Youngstown. Est. $150,000.

SCHOOLS

PROPOSED WORK

Calif., Los Angeles—City School Dist., plans by G. M. Lindsey, 1008 West 8th St., 3 story, basement, rein.-con., brick school and home economics building, Tracy St. $400,000.

Calif., Los Angeles—School Dist., plans by A. S. Nibecker, Jr., City Hall, fireproof auditorium, University Heights School site. $175,000.

Calif., *Palms (Los Angeles P.O.)—Palms-Culver City-West Adams High School Dist. plans by J. C. Austin & F. M. Ashley, 608 Chamber of Commerce Bldg., Los Angeles, 3 story, 64 x 400 ft., rein.-con., brick, stone, steel, tile Robertson Blvd. near Cattaraugus St. $400,000.

Calif., San Jose—San Jose City School Dist. plans by W. H. Weeks, 111 Sutter St., San Francisco, Herbert Hoover Junior High School, 2 story, rein.-con. $250,000.

Calif., Visalia—Visalia Union High School Dist. plans by E. J. Kump Co., Rowell Bldg., Fresno, high school addition, incl. auditorium. $200,000.

Conn., Middle Haddam—Bd. Educ. sketches by Haynes & Mason, Park Bldg., Fitchburg, Mass., 2 story, basement, brick school. $150,000.

Conn., Middletown — School Dpt., B. E. Spencer, plans by Towner & Sellews Associates, Guy & Rice Bldg., brick, steel addition to high school. $150,000. Noted June 5.

Conn., Middletown—City School Dpt., plans by Segerberg & Hoffman, Main St., brick, steel addition to Johnson School. $150,000.

Conn., Wallingford—City, H. M. Jefford, supt. schools, receiving competitive plans for Junior High School. To exceed $150,000. Noted Oct. 31.

Del., Oxford—Lincoln University, c/o Guilbert & Betelle, archts., 20 Branford Pl., Newark, N. J., 2 story, basement, brick, steel dormitory, plain found. $150,000. Noted May 22.

Ill., Alton — St. Mary's Roman Catholic Parish, c/o J. J. Brune, pastor, soon lets contract 2 story, basement, 60 x 160 ft. and 60 x 100 ft. school and convent. $215,000. H. P. Hess, 1001 Ambassador Bldg., St. Louis, Mo., archt.

Ind., East Chicago—School Comrs. plans by Harrison & Turnock, 500 Bd. Trade Bldg., Indianapolis, brick, rein.-con., incl. gymnasium, auditorium, 144th St. and Melville Ave. $150,000.

Ind., Harrisburg — School Comrs., Fayette Co., plans by Henkel & Hanson, Connersville, brick, steel, stone high school. $150,000.

Ind., Jeffersonville—School Comrs., plans by W. Fendt, New Albany, Port Fulton Grade School, brick, steel. $150,000.

Ind., Jeffersonville—School Comrs., plans by W. Fendt, New Albany, 2 story, basement, 60 x 100 ft., brick, steel high school. $160,000. Noted July 10.

Ind., Valparaiso—Valparaiso University soon takes bids 1 story, basement, 150 x 200 ft., rein.-con., brick, college incl. physical building, 35 x 75 ft. swimming pool, 85 x 120 ft. gymnasium. $225,000. Miller & Wallace, 1222 West Adams St., Chicago, Ill., archts.

Mass., Ayer — Town, H. Priest, chn. Bd. Selectmen, soon takes bids 3 story, basement, 65 x 125 ft., brick, stone, high school, plain found., Main St. $150,000 or more. R. H. Doane, 60 Batterymarch St., Boston, archt.

Mass., Fairhaven — Town, W. B. Gardner, chn. School Comn., soon takes bids altering and constructing 2 story, basement, brick, steel Senior High School addition, plain found., Huttleston Ave., near Rogers Square. $200,000. W. Tallman, 222 Union St., New Bedford.

Mass., Jamaica Plain (sta. Boston)—City, Dpt. School Buildings, sketches by J. F. Cullen, 162 Newbury St., Boston, altering and constructing 2 story, basement, brick, steel addition to Edwin P. Seaver Elementary School, plain found. $160,000.

Mass., Holden — Town, c/o W. H. Lowell, plans by Haynes & Mason, 27 Park Bldg., Fitchburg, 9-room, brick school addition. $125,000-$150,000.

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Schools (Continued)

Mass., Hyde Park—Boston Dpt. School Buildings, Boston, sketches by J. M. Gray & J. P. Hefferman, 175 High St., Boston, William Ellery Channing School, 2 story, basement, brick, stone, plain found., Henry Drew Dist. $150,000-$175,000.

Mass., Medford (br. Boston)—City, A. J. Hardy, City Hall, revised plans by Hutchins & French, 11 Beacon St., Boston, 2 story, basement, brick, stone, concrete pile found., Roberts and Playstead Sts. $175,000. Noted July 17.

Mass., Norwood—Town, c/o C. A. Bingham, Municipal Bldg., altering and constructing addition to Senior High School. $150,000 or more. Architect not selected.

N. J., Kearny (sta. Arlington)—Bd. Educ., Devon St., 2 story, basement, Roosevelt School addition, Magnolia Ave. $150,000. Project in abeyance. Noted July 24.

N. J., Linden—Bd. Educ., St. George Ave., plans by H. B. Brady, Inc., 333 North Broad St., Elizabeth, 2 story, basement, brick, steel, rein.-con., senior high school, St. George Ave. $380,000. Noted July 31.

N. J., Mahwah—Bd. Educ., School Building sketches by E. T. Bennet, Mahwah, 2 story basement, brick, steel, plain found., Armour Pl. $150,000.

N. J., Roselle — Bd. Educ., W. F. Bigelow, pres., sketches by H. B. Brady, Inc., 333 North Broad St., Elizabeth, 2 story, basement, brick, steel, high school, plain found., $200,000.

N. C., Hickory—Lenoir-Rhyne College, W. J. Boger, chn. Bd. Trustees, Newton, raising $400,000, buildings.

O., Columbus—Bd. Trustees, Ohio State University, plans by H. Dwight Smith, Ohio State University, 3 and 4 story, basement, brick, concrete botany and biology building addition. $150,000.

O., Sugarcreek—Tuscarawas Co. School Bd. bids in Spring, 2 story, basement Junior High School. $150,000. C. J. Marr, New Philadelphia, archt. Noted Aug. 29.

Pa., Aliquippa—Bd. Educ., I. C. Wright, pres., 110 Major St., plans by Carlisle & Sharrer, Martin Bldg., Pittsburgh, soon takes bids 3 story, basement, brick, steel, Couper Farm. $150,000.

S. C., Columbia—University of South Carolina, D. M. Douglas, pres., bids in August, 3 story, basement, rein.-con., brick, tile educational building. $300,000. J. C. Johnson, Columbia, archt.

Tenn., Clarksville—State, Dpt. Educ., Nashville, plans by E. H. Woolwine, 215 Lea Bldg., Nashville, 3 story, basement girls dormitory. $225,000.

Tenn., Cookeville—State, Dpt. Educ., Nashville, plans by R. H. Hunt, James Bldg., Chattanooga, 3 story, basement science building. $225,000.

Tenn., Knoxville—Universtty of Tennessee, H. A. Morgan, pres., plans by Barber & McMurray, Guarantee Bldg., and soon takes bids 2 story, basement, rein.-con., brick, steel, concrete gymnasium building. $250,000.

Tenn., Murfreesboro—State, Dpt. Educ., Nashville, plans by Marr & Holman, Stahlman Bldg., Nashville, 3 story, basement science building. $225,000.

Tenn., Nashville—State, Dpt. Educ., plans by Marr & Holman, Stahlman Bldg., 3 story, basement class building. $225,000.

Tex., Donna—Bd. Educ., brick, rein.-con. high school. $200,000. Architect not selected.

Tex., Galveston—University of Texas, Bd. Regents, J. W. Calhoun, comptroller, Austin, plans by H. Greene, La Roche & Dahl, 307 Constr. Industrial Bldg., Dallas, 3 story, basement, rein.-con., brick, stone laboratory. $350,000.

Tex., San Antonio—Society of Mary, c/o J. A. Waldron, Cote Brilliante Ave., St. Louis, Mo., plans by H. Driesoerner, 3826 Arsenal St., St. Louis, Mo., probably 3 story, brick, rein.-con., Seninor High School, plain found., North St. Marys St., $300,000; also 2 story, brick, rein.-con., auditorium and gymnasium building, plain found., $150,000. Noted Aug. 7.

BIDS ASKED

Ind., Hammond—Sept. 10, by School Comrs., 2 story, basement, 210 x 325 ft., rein.-con., brick Junior High and Grade School, West Park Dist. $200,000. L. C. Hess, 606 1st Trust Bldg., archts. Former bids rejected.

Mass., Cambridge — Aug. 22, by Coolidge, Shepley, Bulfinch & Abbott, archts., Ames Bldg., Boston, 4 story, basement, brick, limestone, steel, irregular sized dormitory, Unit 5, known as Adams House, plain found., for Harvard University. A. L. Lowell, pres. $2,000,000.

Mass., Cambridge — Aug. 26, by Coolidge, Shepley, Bulfinch & Abbott, archts., Ames Bldg., Boston, 3 story, basement, 2 wings, irregular sized, brick, stone, steel biological institution, plain found., Oxford St. and Divinity Ave., for Harvard University. A. L. Lowell, pres. $2,000,000. Noted July 3.

Mich., North Muskegon — Aug. 28, by Bd. Educ., E. Peterson, secy., 2915 Riverview Ave., 2 story, basement, 62 x 191 ft., brick, steel school, plain found. $150,000. Warren S. Holmes Co., Capitol Savings & Loan Bldg., Lansing, archts.

Mo., Webster Groves—G. E. Henderson, archt., 1398 Arcade Bldg., St. Louis, taking bids two 3 story, basement, 38 x 87 ft., brick, concrete dormitories for Epworth School, M. Norling, supt.

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N. J., Fort Lee—Bd. Educ., J. F. Whitteaker, pres., High School Bldg., bids about Sept. 15, general contract 2 story, basement, brick, steel, addition School 4, plain found., Palisade Ave. $150,000. Hacker & Hacker, 201 Main St., archts. Noted Aug. 7.

N. J., Milburn—St. Rose of Lima, Roman Catholic Church, L. I. Gardner, pastor, c/o Fanning & Shaw, archts., 49 Ward St., Paterson, taking bids general contract 2 story, basement, brick, steel school, plain found. $150,000.

N. J., Rutherford — Bd. Educ., High School, bids about Oct. 1, 2 story, basement, brick, steel, rein.-con. addition to, Washington School, Wood St. $150,000. Edgar I. Williams, 131 West Passaic Ave., archt. Noted Aug. 7.

N. J., Rutherford—Bd. Educ., High School Bldg., bids about Oct. 1, general contract 2 story, basement, brick, steel, Lincoln School, Montross Ave. $150,000. E. I. Williams, 131 West Passaic Ave., archt. Noted July 31.

Ore., Portland — Tourtellotte & Hummel, archts., Postal Bldg., bids about Oct. 7, general contract group 14 buildings, Rocky Botte, for Hill Military Academy, 821 Marshall St. $500,000.

Pa., Villanova — Aug. 25, by P. Monaghan, archt., 1520 Locust St., Phila., School of Commerce and Finance, 3 story, basement, 89 x 166 ft., brick, steel, stone, plain found., for Augustian College.

Wis., Beloit—Aug. 25, by Granger & Bollenbacher, archts., 333 North Michigan Ave., Chicago, Ill., 3 story, basement, brick hall, for Beloit College. $200,000.

Wis., West Allis— Sept. 1, by Bd. Educ., 2 story, basement, 90 x 160 ft., brick, steel, 3rd unit, Washington Junior High School, 54th and Lapham Sts. $360,000. Lindl-Schuttle Inc., 82 East Wisconsin Ave., Milwaukee, archts.

Ont., North Bay—Aug. 25, by S. B. Coon & Son, archts., 4 St. Thomas St., Toronto, 3 story, basement, 35 x 110 ft., rein.-con., stone vocational school, incl. 4 shops, gymnasium, Ferguson St., for High School Bd. $225,000. Noted July 31.

CONTRACTS AWARDED

Ill., Chicago—Bd. Educ., 188 West Randolph St., Lane Technical High School, fireproofing, to U. S. Fireproofing Co., 228 North La Salle St., $284,600; sheet metal, to A. J. Wagner, 3702 North Clark St., $111,909; structural steel, to Reuter Bros., 5816 South Wood St., $377,605; steel erection, to Overland Constr. Co., 205 West Wacker Dr., $159,860; carpentry, to L. Michuda & Son, 10944 South Michigan Ave., $565,817; plastering, to McNulty Bros. Co., 1028 West Van Buren St., $231,000; steam heating, to W. A. Pope, 26 North Jefferson St., $292,600; heat regulation, to National Regulation Co., 2301 North Knox Ave., $25,222; plumbing, to Carl John Stein Co., 166 East Grand Ave., $239,632. Grand total $2,288,245. Switchboards, to Westinghouse Electric & Mfg. Co., 20 North Wacker Dr. Noted July 17.

Ind., Laporte—Bd. School Comrs., general contract brick, steel, stone consolidated school, to T. Larson, Laporte. Est. $150,000.

Mass., Somerville (br. Boston)—City School Comn., 3 story, basement, irregular sized, brick, steel Southern Junior High School, plain found., to Frankini Bros. Co., Inc., 30 Mystic Ave., Medford, $361,000. Noted May 22.

Mass., Brockton—Sacred Heart Parish, J. S. Vermette, pastor, 235 Court St., 2 story, basement, brick, steel parochial school, Manchester and Court Sts., to H. F. Johnson, 248 Belmont St. Est. $150,000. Noted June 26.

Mass., Waverly—Dpt. Mental Diseases, State House, Boston, 2 story, basement, brick dining room kitchen building, plain found., at W. E. Fernald State School, to M. Spinelli, 333 Washington St., Boston. Est. $150,000. Noted Aug. 7.

Mo., Springfield—Bd. Educ., 401 East Central St., general contract Lincoln School and gymnasium building to M. E. Gilloz, Monett, $169,190—plumbing and heating Lincoln School to J. B. McCarty Co., 423 St. Louis St., $11,943 and $13,857 respectively—heating gymnasium to J. D. Manley & Co., 514 College St., $20,415. Grand total $215,405. Noted July 17.

N. H., Manchester — St. Augustine's Parish, A. P. Boire, pastor, 2 story, basement, brick parochial school, Brothers house, plain found., to L. H. Shattuck, Inc., 208 Granite St. Est. $150,000.

N. J., Elizabeth—Bd. Educ., 417 South Broad St., general contract 2 story, basement, brick, steel Grade School 21, plain found., Shelley Ave., to F. J. Schnieder, 514 Jersey Ave., $185,000.

N. J., Scotch Plains—Bd. Educ., High School, general contract altering and 2 story, basement, brick, steel, addition, school 4, to M. Riez, 307 Smith St. est. $150,000. Noted Aug. 7. Plumbing to Adams & Mulready, 332 Benner St., Highland Park—heating to F. A. Vanderweg, 200 Chestnut St., Roselle Park; and electrical work to Commercial Electric and Machine Co., 180 Milberry St., Newark.

N. Y., Brooklyn—Bd. Educ., 500 Park Ave., New York, general contract Brooklyn Technical High School to Fredburn Constr. Co., Linden Blvd. and Schenectady Ave., $3,453,900. Noted June 19.

N. Y., New York — St. Anthony's Roman Catholic Church, 1495 Commonwealth Ave., 3 story, 75 x 120 ft., school, auditorium and gymnasium, to R. Tosti, 2324 Cambreling Ave., est. $250,000.

Ore., Portland—City, general contract 2 story, basement, brick, auditorium for Benison Polytechnic School, to Robertson, Hay & Wallace, Weatherly Bldg., $198,897; heating to Globe Plumbing & Heating Co. $29,355.

THEATRES

PROPOSED WORK

Calif., Oakland—Publix Theatres, Inc., c/o Miller & Pflueger, archts., 580 Market St., San Francisco, theatre, 3,500 seating capacity, Broadway. $1,000,000. Noted Mar. 13.

Calif., Santa Monica—C. C. C. Tatum Building Income Trust, Fidelity Bldg., Los Angeles, 12 story, basement, rein.-con., incl. offices, apartments. $750,000. Private plans.

Calif., Stockton — E. V. Clover, 136 North Sutter St., theatre, stores. $200,000. Architect not selected.

Mass., Pittsfield—W. K. George, 50 Brenton Terrace, plans theatre, Elm St. and Holmes Rd. $150,000. Architect not selected.

Nev., Las Vegas—Cragin & Pike, plans by R. D. King, Van Nuys Bldg., Los Angeles, Calif., theatre. $150,000.

O., Fostoria—N. E. George, Fostoria, plans by A. S. Graven, Inc., 100 North La Salle St., Chicago, Ill., and takes bids about Sept. 1, brick, moving picture building, incl. offices. $150,000.

O., Steubenville—Floto Heirs Estate, plans by A. S. Graven, Inc., 100 North La Salle St., Chicago, Ill., and takes bids about Sept. 1, brick, moving picture building, incl. offices. $150,000.

CONTRACTS AWARDED

Calif., Los Angeles — W. Fox, c/o W. Fox Studios, 1417 North Western Ave., 2 story, basement, 125 x 150 ft., rein.-con., steel, to Sumner-Sollitt Co., 810 West 6th St., $400,000. Noted Aug. 7.

BANKS

PROPOSED WORK

O., Hamilton—Weary & Alford, archts., 1923 Calumet Ave., soon take bids 2 story, brick, stone, bank and office, for 2nd Natl. Bank. $300,000. Noted July 24.

CONTRACTS AWARDED

Mich., Battle Creek—Holabird & Root, archts., 333 North Michigan Ave., Chicago, Ill., general contract 22 story, brick, rein.-con., stone, steel, terra cotta bank, office, to Lundorff-Bicknell Co., 100 North La Salle St., Chicago, Ill., for Central National Bank. Est. $1,250,000. Noted July 3.

O., Cincinnati—Graham, Anderson, Probst & White, archts., 80 East Jackson Blvd., Chicago, Ill., general contract 17 story, basement, rein.-con., brick, steel bank, plain found., to Ferro Concrete Constr. Co., 3rd and Elm Sts., for Fifth-Third Union Trust Co., Walnut St. Est. $1,000,000. Contractor takes sub-bids. Noted July 24.

OFFICES

PROPOSED WORK

Calif., Los Angeles—See "Stores."

N. J., Hackensack—Eagle Development Co., J. Marx, in charge, 8 West 40th St., New York, 2 story, basement, office, Main St. and Washington Pl. Project in abeyance. Noted June 12.

N. J., Paterson — Owner, c/o Goodman & Shulman, archts., 20 Smith St., 10 story, basement, brick, steel medical office, stores, Bway. and Auburn Sts. $600,000. Noted Aug. 7.

O., Cleveland—Kayline Fixture Co., B. F. Klein, pres., 600 Huron Rd., plans by A. Brett, Ulmer Bldg., 6 story, basement, 80 x 120 ft., brick, rein.-con. office and garage, 634 Huron Rd. $400,000.

O., Steubenville—See "Theatres."

Pa., Pittsburgh—E. L. Bartley, Morrowfield Hotel, plans by M. Nirdlinger, Empire Bldg., 5 story, basement, 160 x 160 ft., office for medical and surgical profession, incl. 400-car garage, rein.-con., brick, stone, 5th Ave. and Atwood St.

BIDS ASKED

N. J., Hackensack—Owner, c/o P. J. Jossier, archt., 240 Broad Ave., Palisade Park, bids about Oct. 1, 2 story, basement, 60 x 120 ft., brick, steel, office, showroom, stores, Main St. $150,000. Noted July 31.

CONTRACTS AWARDED

Mass., Cambridge — F. W. Webster Co., 340 Congress St., Boston, 4 story, basement, 100 x 200 ft., brick, concrete, office and manufacturing building, concrete found., Wadsworth and Hayward Sts., to Turner Constr. Co., 137 Newbur St., Boston. To exceed $150,000.

N. Y., St. George—J. Whitford, archt., 56 Bay St., general contract 6 story, basement, brick, steel, professional building, Central Ave., to M. Shapiro & Sons, 1560 Bway., New York, for Staten Island Medical Arts, Inc., 6 Van Duzen St., Tompkinsville, est. $250,000. Noted July 10.

STORES

PROPOSED WORK

Calif., Los Angeles — T. P. Barber & P. Kingsbury, archts., 628-29 Union Insurance Bldg., sketches rein.-con., tile church, 600 seating capacity. $150,000.

Stores (Continued)

Calif., Los Angeles — S. C. Lee, archt., Petroleum Securities Bldg., plans 10 story (incl. 8 story tower), concrete, steel, Wilshire Blvd., $150,000. Owner's name withheld.

Calif., Los Angeles—C. C. Tatum Building Income Trust, Fidelity Bldg., plans by C. F. Plummer, 1108 Story Bldg., 12 story, basement, 120 x 165 ft. fireproof store, incl. office and garage, 2nd and Hill Sts.

Calif., San Diego—Carmelite Sisters, sketches probably rein.-con., steel monastery. $175,000. Architect not selected.

Ind., Ft. Wayne—Boston Furniture Co., 1610 Calhoun St., plans by A. M. Strauss, 415 Cal-Wayne St., 3 story, basement, 75 x 150 ft., brick, steel, Grant and Calhoun Sts. $150,000.

N. J., East Orange—Starret & Van Vleck, archts., 393 7th Ave., New York, soon lets contract 4 story, basement, 100 x 100 ft., brick, steel, rein.-con. department store, Main and Prospect Sts., for R. H. Muir, 546 Main St. $150,000.

N. J., Sea Bright—Mulford Eng. Co., Plaza Sq., plans 1 story, 100 x 100 ft., brick, steel, stores and motor boat showroom, Plaza Sq., $150,000. Private plans. Noted Aug. 7.

Ont., Toronto — Robins Ltd., 347 Bay St., plans by C. Dolphin, 10 Leader Lane, 3 story, basement, concrete, brick, steel, stone, store, Yonge St. $150,000.

BIDS ASKED

N. J., Paterson—Davis Stein, 491 East 26th St., taking bids separate contracts 3 story, basement, brick, steel, stores and apartment, 1109-13 Main St. $150,000. E. R. Coe, 136 Washington St., archt. Noted July 24.

O., Cleveland—Aug. 11, by Lehman-Schmitt Co., archts., Newman Stern Bldg., 8 story, basement, 64 x 115 ft., brick, terra cotta, rein.-con. store, office, East 9th and Chester Sts., for Acme Realty Corp., D. F. Crawford, secy., 308 Euclid Ave. $400,000.

CONTRACTS AWARDED

N. J., Lyndhurst—Owner, c/o P. J. Jossier, archt., 242 Broad Ave., Palisades Park, general and separate contracts 2 story, basement, 90 x 100 ft., brick, steel, incl. apartments. $150,000. Noted Aug. 8.

O., Cincinnati—Howard Wurlitzer Estate, 505 Walnut St., 3 story, basement, 81 x 154 ft., rein.-con., brick store, plain found., McMillan St., to M. J. Roche Constr. Co., Southern Ohio Bank. $250,000.

PUBLIC

PROPOSED WORK

Tenn., Jackson—ARMORY—City and State, plans by J. H. Parmelee Nashville Trust Bldg., Nashville, armory. $150,000.

BIDS ASKED

Mass., Mattapan —BRANCH LIBRARY—Aug. 28, by City of Boston Library Dpt., Copley Sq., Boston, 1 and 2 story, basement, brick, limestone, plain found., 8-10 Hazelton St. $150,000. Putnam & Cox, 114 State St., Boston, archts.

Mass., North Adams—ARMORY—Aug. 27, by Commonwealth of Massachusetts, Armories Division, State House, Boston, 2 story, basement, 84x160 ft., granite limestone, brick, steel, Porter and Ashland Sts. $150,000. McLaughlin & Burr, 88 Tremont St., Boston, archts. Noted July 17.

Pa., Pottsville—COURT HOUSE—Sept. 4, by Schuylkill County Comrs., altering and additions, court house, $400,000. E. F. Wood, Hardy & Hayes Bldg., Pittsburgh, archts.

CONTRACTS AWARDED

Ind., Knightstown—ORPHANS HOME—Bd. Comrs. Soldiers and Sailors Orphan Home, general contract 2 story, basement, brick, steel, to P. Hockstetter, 302 South Main St., Newcastle. Est. $150,000. Noted July 17.

Ind., Muncie — MAUSOLEUM — Elm Ridge Park, general contract 1 story, 65 x 150 ft., rein.-con., marble, limestone, Elm Ridge Cemetery, to A. M. Abbott, Co., 110 North Main St., Walnut St. Est. $150,000.

Ind., Rockville—ASYLUM—Parke Co., general contract rein.-con., brick, to Welch Constr. Co., Rockville. Est. $150,000. Noted Aug. 7.

Mo., Osage—REFORMATORY—Missouri State Penal Bd., Jefferson City, rein.-con., stone, cottage type, intermediate reformatory, 2 mi. from here by convict labor. $750,000. W. B. Ittner, Inc., Continental Life Bldg., St. Louis, archt.

Okla., Muskogee—CITY HALL—City, c/o Mayor, 3 story, basement, rein.-con., brick, plain found., to Manhattan Constr. Co., Muskogee. $250,000 cost plus 5 per cent. Noted Apr. 24.

BUILDINGS—UNCLASSIFIED

PROPOSED WORK

Calif., Compton—MAUSOLEUM—Angeles Abbey Mausoleum plans by C. N. Aldrich, Pacific Southwest Bldg., Long Beach, marble, terrazzo, rein.-con. $500,000.

Calif., Long Beach—MAUSOLEUM—Sunnyside Mausoleum Co. plans by C. L. Jay, 871 East Washington St., Pasadena, 2 and 3 story, basement, 50 x 275 ft., rein.-con., 1,000 crypt, stucco art stone, marble, bronze, Cherry Rd. $150,000.

Calif., Los Angeles—LABORATORY—Brunswig Drug Co., 501 North Main St., 5 story, basement, 150 x 250 ft., rein.-con. laboratory, warehouse, 2nd and San Pedro St., $750,000. Architect not selected.

Conn., Torrington — EXCHANGE — Southern New England Telephone Co., 157 Church St., New Haven, soon lets contract 2 story, basement, 100 x 100 ft., brick, steel marble telephone exchange. $200,000. R. W. Foote, 185 Church St., New Haven, archt. Noted Aug. 7.

Ind., Gary—COMMUNITY—Union Espanol, T. Bibillo, secy., plans by J. H. Wildermuth, 583 Bway., 2 story, basement, 65 x 100 ft., brick, steel, 11th and Van Buren Sts. $150,000.

Mass., Quincy—EXCHANGE—New England Telephone & Telegraph Co., 50 Oliver St., Boston, telephone exchange, Merrymount Rd. and Hancock St. $150,000-$200,000. Architect not selected.

Mass., Worcester—HOME—Jewish Home for Aged, 25 Coral St., plans by Fuller & Delano, 44 Front St., brick, steel home, Kendall Estate. $150,000 or more.

Mich., Big Rapids — EXCHANGE — Michigan Bell Telephone Co., 1365 Cass Ave., Detroit, plans by Smith, Hinchman & Grylls, archts. and engrs., 800 Marquette Bldg., Detroit, 2 story, basement, 52 x 82 ft., brick, rein.-con., plain found., Maple St. $175,000.

Mo., St. Louis—TERMINAL, WAREHOUSE and OFFICE—Illinois Terminal R.R. Co., E. S. Hight, ch. engr., Shell Bldg., plans by Mauran, Russell & Crowell, Chemical Bldg., 20 story, basement, sub-basement, rein.-con., brick, steel, stone, railroad terminal, office and warehouse, Lucas Ave., 12th, High and Morgan Sts. $5,000,000. Clearing site and excavating to G. Locke Tarlton Co., Ambassador Bldg.

N. J., Spring Lake—EXCHANGE—New Jersey Telephone Co., A. C. Havens, pres., 540 Broad St., Newark, plans brick, telephone building, Morris and 3rd Aves., $150,000. Engineer and architect not selected.

N. J., West Long Branch—MAUSOLEUM—Glenwood Mausoleum Association, J. S. Applegate, Broad St., Red Bank, plans by G. B. Webb, 10 East 43rd St., New York, mausoleum. $150,000.

R. I., Pawtucket—EXCHANGE—New England Telephone & Telegraph Co., 50 Oliver St., Boston, Mass., plans by Jenks & Ballou, New Industrial Trust Bldg., Providence, telephone exchange building. To exceed $150,000. Noted Jan. 30.

Tex., Fort Worth — PRODUCE MARKET — Texas Ice & Refrigerating Co., C. Goodfellow, plans 1 and 2 story, brick, rein.-con., produce market Ives St. between 10th and 12th Sts. $500,000 incl. equipment.

BIDS ASKED

Mass., Lawrence—RAILROAD STATION—Aug. 22 by Boston & Maine R.R. Co., W. J. Backes, ch. engr., Boston, taking bids, brick, steel station. $300,000. Ashton, Huntress & Alter, 477 Essex St., archts. Noted May 22.

Mass., Malden (br. Boston) — INDUSTRIAL AID — Malden Industrial Aid Society, E. F. Butler, 41 Walnut St., taking bids 3 story, basement, brick, steel, irregular sized, plain found., 21 Forest St. Mowl & Rand, 21 School St., Boston, archts.

Mass., Roxbury — COMMUNITY HOUSE — Robert Gould Shaw House, Inc., c/o E. Q. Sylvester, archt., 8 Beacon St., Boston, taking bids 3 story, basement, brick, steel community house plain found., Windsor St. $150,000.

CONTRACTS AWARDED

Ind., Franklin — HOME — Indiana Masonic Home, general contract rein.-con., brick boys dormitory, to R. Bryant, Franklin. Est. $150,000.

Ia., Davenport—EXCHANGE—Northwestern Bell Telephone Co., 5th and Main Sts., general contract 2 and 3 story, basement, 38 x 98 ft. brick, concrete, steel, tile addition, 528 Main St., to John Soller Constr. Co., Old Masonic Temple. Est. $200,000. Noted Jan. 2.

Pa., Sharpsburg—EXCHANGE—Bell Telephone Co. of Pennsylvania, 416 7th Ave., Pittsburgh, general contract 2 story, basement, 50 x 70 ft., brick, hollow tile, to W. F. Trimble & Sons Co., 1719 Pennsylvania Ave., N. S., Pittsburgh. Est. $700,000 including equipment. Noted Jan. 23.

Buildings

FACTORIES AND MILLS

PROPOSED WORK

Calif., Los Angeles — FACTORY — Coopers Kenoshas, c/o B Grover, 768 South Los Angeles St., plans Class A factory in industrial district, $2,000,000. Architect not selected.

Calif., Los Angeles — PLANT — Consolidated Steel Corp., 1200 North Main St., plant, Slauson and Eastern Aves. Private plans.

Calif., Los Angeles — PLANT — Consolidated Steel Corp., 1200 North Main St., plant, Slauson and Eastern Aves. Private plans.

Fla., Lake Wales—PACKING PLANT—Ridge Citrus Canners, Inc., H. S. Norman, pres., 100 x 200 ft. plant. $60,000 incl. equipment.

Idaho, Wardner—CONCENTRATION MILL—J., G. and F. Bingham, Wardner, plans 150 ton capacity concentration mill.

Ill., Carbondale—PLANT—Kroger Grocery & Baking Co., 7th and Walnut Sts., Cincinnati, O., sketches by E. H. Niemann, 3816 Shaw Blvd., St. Louis, Mo., 1 and 2 story, 250 x 300 ft., rein.-con., brick distributing plant. $125,000.

Ill., Chicago—SAUSAGE FACTORY—H. P. Henschien, archt., 59 East Van Buren St., soon takes bids 2 and 3 story, basement, 265 x 345 ft., brick, steel, sausage factory, Randolph and Carpenter Sts., for Richter Food Products Co., 2910 Armitage Ave., est. $500,000.

Ind., Ft. Wayne—FACTORY—General Electric Co., E. A. Barnes, supt., plans rein.-con., brick, Winter St. and Wabash R.R. $250,000. Private plans.

Ind., Muncie—GAS PLANT, etc.—See "Contracts Awarded."

Mass., Fitchburg—FACTORY—Simonds Saw & Steel Co., G. K. Simonds, genl. mgr., 360 x 550 ft., brick, steel, concrete factory, Railroad St., East Fitchburg. $1,000,000. Private plans.

Mass., Wareham—FACTORY—Wareham Mfg. Co., J. J. Beaton, pres., reconstructing horseshoe factory in South Wareham Sect. $50,000 or more. Architect not selected.

N. J., East Rutherford — FACTORY — East Rutherford Syringe Co., 75 Mozart St., plans by J. T. Camlet, 26 Piaget Ave., Clifton, 2 story, basement, brick, steel, factory, 54 Mozart St. $40,000. Noted Aug. 7.

N. J., Newark—FACTORY, etc.—A. Kamiski, c/o R. C. Klemm, archt., 944 Broad St., sketches 1 story, basement, brick, steel, factory, garage, Oxford St. $40,000.

N. J., New Providence — TELEVISION LABORATORY — American Telephone & Telegraph Co., 195 Bway., New York, plans television research laboratory, Mountain Ave., $40,000. Engineer and architect not selected.

O., Akron—ICE CREAM PLANT—Braziell & Anderson, archts. and engrs., 309 4th Ave., Pittsburgh, Pa., soon lets contract 3 story, basement, 104 x 122 ft., brick, steel, West Cedar and Water Sts., for Telling-Belle Vernon Co., 231 East Exchange St. J. F. Vance, Akron, advisory engr.

Ore., Medford — REDUCTION MILL — Consolidated Copper Co., Medford, J. F. Reddy, pres., plans copper reduction mill.

Pa., Phila.—BAKERY—C. B. Comstock, archt., 122 East 42nd St., New York, soon lets contract 1 story, basement, 30 x 280 ft., brick, steel, plain found., 20th and Indiana Sts., for Freihofer Baking Co., 20th and Indiana Sts. $75,000.

Vt., Rutland—MARBLE CUTTING PLANT—Vermont Marble Co., E. Belcher, engr., marble cutting plant. $125,000. Private plans.

Wash., Longview—PULP MILL—Wyerehauser Timber Co., A. L. Raught, mgr., plans 150 ton sulphite pump mill.

Ont., Penetanguishene—BOILER FACTORY—Dominion Stove & Foundry Co., 1 story, brick, steel addition, incl. special machinery, equipment, $75,000. Private plans.

T. H., Honolulu—FACTORY—Love's Biscuit and Bread Co., Honolulu, plans 3 story, basement, factory. $300,000.

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Factories and Mills (Continued)

BIDS ASKED

Calif., Hollywood—NEWSPAPER PLANT—Hollywood News Publishing Co., taking bids 2 story, basement, 143 x 144 ft., rein.-con., stone, 1541-49 Wilcox Ave. $200,000. F. D. Rutherford, 205 Mills-Fraser Bldg., Santa Monica, archt. Noted June 26.

N. J., Newark — WOODWORKING PLANT — M. N. Shoemaker, archt., 15 Central Ave., taking bids general contract 3 story, basement, 50 x 100 ft., brick, plain found., New York Ave., for J. C. Kohaut, Inc., 117 Green St., est. $40,000.

N. Y., Brooklyn—FACTORY—Two Hundred Twenty Nine Havemeyer Street Corp., c/o J. Stressinger, 545 5th Ave., New York, taking bids 2 story, 40 x 90 ft. factory, Havemeyer St. Bway. $40,000. G. and E. Blum, 415 Lexington Ave., New York, archts.

Tex., Galveston—MANUFACTURING PLANT—E. J. Hoffman Mfg. & Development Co., c/o E. J. Hoffman, taking bids 1 story, 50x200 ft., brick, concrete plant. Private plans. Tar and gravel roofing, etc.

Wis., Milwaukee — FACTORY — Milwaukee Gear Co., 1222 3rd St., taking bids 1 and 2 story, 100 x 200 x 200 ft., brick, steel, plain found., South Pierce St. Private plans.

CONTRACTS AWARDED

Calif., Long Beach—STEEL PLANT—Ford Motor Car Co., 3674 Schaefer Rd., Dearborn, Mich., 1 story, 86 x 480 ft., rein.-con., brick pressed steel unit, to Clinton Constr. Co., Spring-Arcade Bldg., Los Angeles. $350,000.

Calif., Oakland—FACTORY—Burnham Candy Co., 2355 Leavenworth St., San Francisco, part 2 and 3 story, timber, stucco, 46th and Telegraph Sts., to Vogt & Davidson, 185 Stevenson St., $40,250.

Calif., Sacramento—FACTORY—H. W. Rivett Co., 1301 J St., factory, Y St., to C. J. Hopkinson, 1810 28th St., $41,000.

Calif., San Francisco — FACTORY — Cereal Products Refining Co., Fulton and Webster Sts., 2 story, basement, rein.-con., Fulton and Webster Sts., to R. J. H. Forbes, Monadnock Bldg., $45,000.

Calif., San Mateo—CREAMERY—Jersey Farm Creamery, rein.-con., Bayshore Hy., to F. Boring, 1045 Balboa Ave., Burlingame. $42,500.

Ga., Atlanta—PACKING PLANT—Kingan & Co., 153 Alabama St., 2 story, basement, 70 x 137 ft., brick, rein.-con. plant, Peters and Fair Sts., to Brazell-Miller & Newbanks, Inc., Norris Bldg. Est. $110,000.

Ind., Muncie — GAS PLANT, etc. — Central Indiana Gas Co., E. A. Angley, genl. mgr., plant, 78 mi. high pressure lines, 100 mi. distributing lines. Owner builds. $1,000,000 incl. machinery, equipment.

Ind., South Bend—FACTORY—Roach-Appleton Co., general contract 1 story, 200 x 250 ft., brick, steel, Belleville, to Ralph Sollitt & Sons, 518 East Sample St. Est. $100,000. Noted July 31.

Me., Waterville—BAKERY—J. J. Nissen Baking Co., 63 Washington St., Portland, 2 story, brick, concrete bakery, to P. P. Carey, 40 Main St. Est. $40,000.

Mass., Billerica—SAND BLAST EQUIPMENT BUILDING—Boston & Maine R.R., W. J. Backes, ch. engr., Boston, 1 story, brick, steel, plain found., to H. L. Hauser Building Co., Inc., 263 Summer St., Boston. Est. $40,000. Noted Aug. 15.

Mass., Charlestown (sta. Boston)—FACTORY—W. F. Schraffts Co., 529 Main St., altering 6 story 200 x 485 ft., brick, rein.-con., Main St., to Turner Constr. Co., 137 Newbury St., Boston.

N. J., Elizabeth—SHIRT FACTORY—A. J. Blum, 1109 Elizabeth Ave., general contract 2 story, basement, 56 x 174 ft., brick, steel, 1126-30 Dickinson St. to Isak Enzer, 21 Orchard St., Est. $40,000. Prominent Shirt Co., 1107 Bway., New York, lessee.

O., Galion—FACTORY—U. S. Grave Vault Co., 1 story, 90 x 310 ft., brick, steel, to Austin Co., 16112 Euclid Ave., Cleveland. Est. $100,000.

Pa., Phila. — LABORATORY — Midvale Co., 4300 Wissahickon Ave., 2 story, basement, 50 x 100 ft., brick, steel, concrete found., to Barclay White Co., 22 North 36th St. Noted July 10.

Vt., Rutland—MARBLE CUTTING PLANT—Vermont Marble Co., E. Belcher, engr., brick plant. $125,000. Owner builds. Private plans. Noted Aug. 14.

Wis., Beaver Dam—FACTORY—Bear Brand Hosiery Co., 4 story, 85 x 99 ft., brick, steel, rein.-con., factory to Immel Constr. Co., Fond du Lac.

Wis., Milwaukee — DYE PLANT — Novelty Dye Co., 375 Jefferson St., general contract 1 story, 150 x 280 ft., brick, stone, to H. Schmitt & Son, Inc., 14 Burleigh St.—structural steel to Worden Allen Co., Port Washington Rd.—plumbing to Dahl Plumbing Co., 1613 State St.—heating to P. E. Mueller, 320 Park St.—and electrical work to Mogan Electric Co., 422 Jefferson St., est. $151,000.

Wis., Milwaukee—FACTORY—Moise Steel Co., 447 Virginia Ave., 1 story, 73 x 225 ft., brick, steel factory, to Bentley Bros., 808 South Pierce St.—structural steel to Worden Allen Co., Port Washington Rd.—plumbing to J. Wittig, 615 East Water St.— refrigeration to Wending Refrigeration Co., 68 East Wisconson Ave.—steel sash and Thomas Glaz Co., 440 27th St.

Wis., Milwaukee — STEEL ADMINISTRATION — Inland Steel Co., 221 Wisconsin St., general contract 2 story, 50 x 60 ft., brick, tile administration building to Worden-Allen Co., Port Washington Rd., est. $100,000. Noted July 31.

Ont., Belleville—PLANT—Budweiser Brewery Co. of Canada Ltd., rebuilding concrete, brick plant damaged by fire, to Patterson Constr. Co. Est. $50,000.

Ont., Guelph — PLANT — Guelph Carpet & Worsted Spinning Mills Ltd., altering and constructing concrete, brick, steel addition, to Ball Bros., 33 King St. E., Kitchener. Est. $50,000.

GARAGES

PROPOSED WORK

Fla., New Smyrna—Gulf Refining Co., C. H. Sams, local mgr., brick service station on riverfront, 500 ft. steel bulkhead from Hillsboro St. to main channel, also 160 ft. bulkhead north along channel. $50,000.

Mass., Cambridge—American Oil Co. of Massachusetts, 465 Rindge Ave. plans 1 story, basement, irregular sized, brick, rein.-con., steel garage and super service station, 104 Mt. Auburn St., $60,000. Fay, Spoffor & Thorndike, 44 School St., Boston, engrs.

Mass., New Bedford—J. S. Neves, Jr., 321 Dartmouth St., 1 story, concrete auto service and repair shop, Rockdale Ave. and Dartmouth St. $50,000. Private plans.

Tenn., Memphis—Bob Rust Motor Co. Inc., 44 North Watkins St., 100 ft. front, plans by J. T. Wallace, Bank of Commerce Bldg., 1 story, brick, stone garage, Watkins St. $40,000. R. T. Dippell, Bank of Commerce Bldg., engr.

Texas—Tinallium Products Co., A. Tinally, pres., Builders Exch. Bldg., San Antonio, plans G. Kelwood Co., 703 Travis Bldg., San Antonio, service stations at San Antonio, Dallas, Houston, Amarillo, El Paso and other towns.

BIDS ASKED

Conn., Hartford—Herrup Corp., 64 Pearl St., taking bids 1 story, basement, 75 x 75 ft., brick, steel service garage, Elm St. $40,000 incl. equipment. A. Feinberg, 1127 Main St., archt.

Mass., Newton—Elmwood Street Garage, 49 Elmwood St., taking bids, 1 story, brick, rein.-con., steel service garage, concrete found., Elmwood St. $40,000. W. J. Freethy, 23 Commonwealth Ave., archt.

CONTRACTS AWARDED

Ark., Little Rock—Bale Chevrolet Co., Little Rock, 1 story, basement, 140 x 200 ft., rein.-con. garage, warehouse and service building, 56,000 sq.ft. floor space, 2nd St. and Bway., to F. Parrot, 2405 Battery St., $200,000. Noted June 27.

Ill., Chicago—Car Service, Inc., F. O. Becker, pres., 4457 Greenwood Ave., general contract 4 story, 90 x 143 ft., repair and service garage, 1921 Indiana Ave., to H. Ericsson Co., 228 North LaSalle St., $250,000.

Ind., Ft. Wayne—T. E. Snook, general contract brick, steel superservice station, 502 West Jefferson St., to A. E. Snook, Ft. Wayne. Est. $41,100

Ind., Gary—Standard Oil Co., general contract brick, steel super-service station, 5th and Taylor Sts., to Marcello Germetta, 515 Bway. Est. $40,000.

Ind., Indianapolis—National Refining Co., 538 South Harding St., general contract brick, steel super-service station, to Krebay Constr. Co., 802 City Trust Bldg. Est. $40,000.

Pa., Pittsburgh — R. Bowler, 350 South Aiken Ave., 2 story, 85 x 100 ft., brick, tile, concrete garage to C. Valenti, 6423 Bennett St.

SHOPS AND FOUNDRIES

PROPOSED WORK

Mich., Detroit — FOUNDRY — Detroit Gray Iron Foundry, 6403 Wight St., plans by Mildner & Eisen, 924 Hammond Bldg., 2 story, 115 x 170 ft., brick, steel addition, incl. equipment, plain found., Meldrum Ave. $50,000.

Pa., Pittsburgh—SHOP—National Valve & Mfg. Co., H. Haller, pres., 3101 Liberty Ave., soon lets contract 1 story, 48 x 100 ft., brick, steel, shop extension. Private plans.

CONTRACTS AWARDED

N. J., Newark—AUTO RADIATOR SHOP—M. A. Wolf, archt., 845 Broad St., general contract 2 story, basement, brick, steel, to State Builders, Inc., 24 Commerce St., for J. Black, 246 Central Ave., est. $50,000. Noted Aug. 7.

POWER PLANTS

PROPOSED WORK

Me., Gardner—Hollingsworth & Whitney Co., Gardner, sketches altering and constructing 1 story, brick boiler house addition. $40,000. C. T. Main, Inc., 201 Devonshire St., Boston, Mass., engrs.

Mass., Cambridge — Cambridge Industrial Trust, 25 State St., plans 1 story, concrete, steel, power house, cnocrete found., State St. $40,000. W. A. Hall, 80 Boylston St., Boston, engrs.

Mass., Holyoke—Holyoke Water Power Co., sketches hydro-electric power plant, Appleton St., Holyoke, or South Hadley Falls, (br. Holyoke). Est. exceeds $150,000. Private plans.

Okla., Muskogee—City preliminary plans electric light plant for street lighting. $75,000. E. Brock, Muskogee, engr.

Okla., Westville—Siloam Springs, Ark., preliminary plans hydro electric power plant on Illinois River, near here. $200,000. V. H Cochrane, Wright Bldg., Tulsa, engr.

Okla., Woodward—City preliminary plans electric light plant. $125,000. H. M. Renner, Woodward, engr.

Ore., Tenmile—Citizens Com., J. G. Barnes, Roseburg, plans engaging engineer to make surveys for power dam, generating and distributing machinery.

Pa., Tarentum—City soon takes bids addition to light plant, installing 1,000 kw. generator. $150,000.

BIDS ASKED

Ind., Goshen—Aug. 27, by Bd. P. Wks., C. E. Firestone, complete electric generating plant in electric light and waterworks plant. $200,000.

Ind., Indianapolis—Aug. 29, by Bd. Trustees Central State Hospital turbo-generator set and foundation. $27,410. Bevington-Williams, Inc., 1139 K. and P. Bldg., engrs.

N. J., Woodbine—Aug. 26, by Dpt. Institutions & Agencies, State Office Bldg., Trenton, power house equipment, water, steam and return lines. $25,000. Division of Archt. and Constr., Trenton, archts.

O., Columbus — Aug. 22, by Comrs. Franklin Co., F. L. Donnally, clk. altering and constructing additions to power house at county home, here. W. H. Tremaine, 28 East Broad St., archt. Noted June 26.

Pa., Warren—Aug. 27, by Warren State Hospital, 1 story, 53 x 60 ft. addition, cold storage plant, at State Hospital. J. E. Woodwell, 501 5th Ave., New York, archt. Noted Nov. 21.

CONTRACTS AWARDED

Calif., Pasadena—City, 1 story, 108 x 150 ft., rein.-con., steel. $150,000. Work will be done by City Constr. Dept. Noted July 31.

Conn., Norwich—City Gas & Electric Dpt., 34 Shetuck St., brick, gas and electric distribution plant, North Main St., to P. F. Sweeney, 25 Chestnut St. Est. $40,000.

Ind., Indianapolis—City Hospital, 960 Locke St., power plant, electric wiring, motor placing changing current, to Sanborn Electric Co., 309 North Illinois St., $56,242.

Kan., Holton—City, 600 kw. oil engine, to Worthington Pump & Mchy. Corp., 710 Dwight Bldg., Kansas City, Mo., $43,283. Noted July 31 "Daily."

Mass., Cambridge — Cambridge Industrial Trust, 25 State St., 1 story, concrete, steel, power house, concrete found., State St., to S. C. Sperry Co., 288 Main St. Est. $40,000.

Mo., Columbia—City, coal handling equipment in power house, to Link Belt Co., 910 South Michigan Ave., Chicago, Ill., $12,727.

Vt., Charleston (mail Derby Line)—Village of Barton, A. Cutting, Baton, brick, steel, concrete power plant addition to C. D. Marsh Constr. Co., Woodsville, N. H. Est. exceeds $40,000. Noted Aug. 7.

WAREHOUSES

PROPOSED WORK

Ill., Chicago—Salvation Army, 717 North State St., soon lets contract 2 story, 100 x 107 ft., brick, stone, warehouse, 2250 Clybourn Ave. $120,000. A. C. Fehlow, 717 North State St., archt.

Mass., Boston—J. J. White & Sons Co., 102 A St., South Boston, plans rebuild 2 story, brick, concrete warehouse, A St., South Boston. $50,000. Architect not selected.

Mass., Brockton (sta. Boston) — Mexican Petroleum Corp., Park Sq. Bldg., Boston, 1 story, 125 x 150 ft., concrete, steel, warehouse, concrete found., Spark St. Private plans.

N. J., Clifton—Erie R. R. Co., G. S. Fanning, ch. engr., 30 Church St., New York, sketches 2 story, basement, brick, steel, plain found., Lakeview Sect. $150,000.

Ont., Fort William—Canadian Natl. Rys., New Union Sta., Toronto, T. T. Irving, ch. engr., rebuilding freight sheds destroyed by fire. $1,000,000 loss.

BIDS ASKED

Calif., Los Angeles — Morgan, Walls & Clements, archts., Van Nuys Bldg., taking bids 5 story, basement, 50 x 100 ft., rein.-con., Banning St., for Los Angeles Soap Co., 617 East 1st St.

CONTRACTS AWARDED

Pa., Carnegie—H. F. Kunkel Granite Co., 1012 East Ohio St., N. E., Pittsburgh, 1 story, 28 x 60 ft., monumental display building, to C. Martini, Stanton Ave., est. $40,000.

Pa., Connellsville—Canstan Glass Co., 1 story, 116 x 200 ft., brick, steel warehouse, to Austin Co., 16112 Euclid Ave., Cleveland, O. Est. $150,000.

See proposal advertising on page 109